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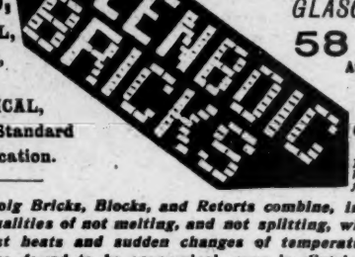

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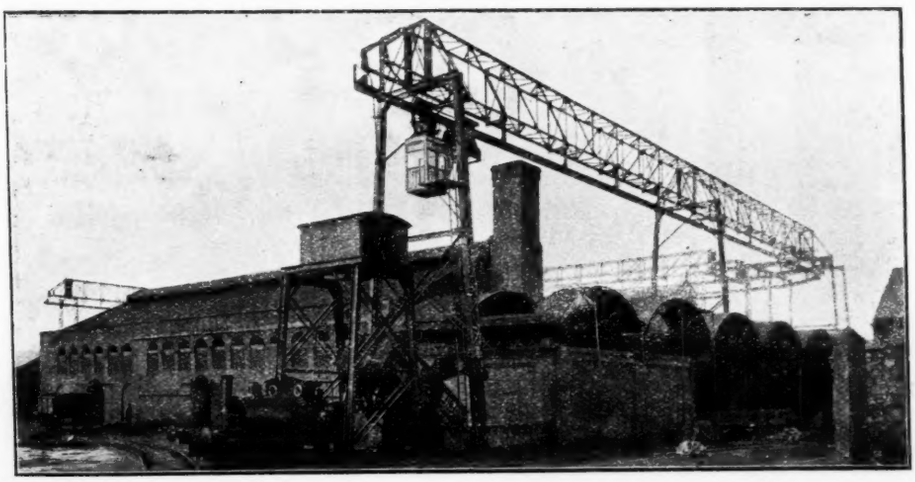

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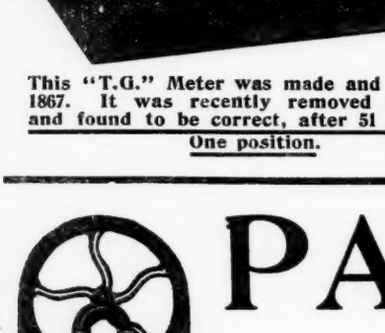

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VOL. CXLVI., No. 2924.] TUESDAY, MAY 27, 1919. [71ST YEAR.

EDITORIAL NOTES.

A Matter of Immediate Importance.

TIME passes. Another five weeks will see us at the end of June, and likewise, unless something effective is speedily accomplished, at the end of the protection that the Board of Trade gave the gas industry in the circular-letter, signed by Mr. Garnham Roper, and dated Dec. 16 last year. This letter, on grounds stated in it, extended the relief (originally conferred in June, 1918) from old standards, and allowed the calorific power of the gas to fall to 450 B.Th.U., so long as the proportion of inert constituents in the gas was not excessive. Now it is understood that the Board of Trade have shown no signs of any intention to continue the protection, and are, in fact, waiting for a positive lead from the National Gas Council. It is not putting the position too strongly to say that it would be a disastrous thing for the industry if the protection were to lapse now before there is legislative action on the report of the Board of Fuel Research, as modified perhaps in two or three particulars. This question of continued protection is of such importance, and involves such vast consequences, that it would at the moment be infinitely better for the National Gas Council to concentrate upon it than upon the question of inerts. It follows that, if the old standards are re-established—with the conditions of the industry as bad as they are in regard to coal deliveries and price, and the financial situation what it is—the industry will be precipitated into greater chaos; and no one will be a bit the gainer. On the contrary, the gas consumers in many areas will be losers, because the price of gas will inevitably have to be further raised, without, as the Fuel Research Board's report indicates, and investigation in other quarters has proved, any good resulting to anyone from the cause of the advance.

The position last December fully justified the extension of protection to gas undertakings from the results that would have ensued, and would still ensue, from the reimposition of the old standards. The position to-day has in it great warrant for the continuation of the protection. It was five months ago based upon the representations of the Coal Controller as to coal output and deliveries, and the necessity in the country's interests of allowing gas undertakings to conserve coal as much as possible by utilizing blue water gas or by charge steaming. The situation of gas undertakings in respect of coal deliveries is still an uncomfortable one; and the Acting President of the Board of Trade (Sir Auckland Geddes) made an ominous statement in the House the other evening as to the trend of output. Now supplementing the coal position is the report of the Board of Fuel Research, which is as strong a condemnation of the futility and extravagance of reimposing the old standards as the Board of Trade could possibly wish to support them in any action they may take to continue the protection. In order that the importance of the matter may be urged in the proper quarter, the question should be raised as one of emergency at the meeting of the Institution this week; and a resolution regarding it might be sent to the National Gas Council.

The question of inerts is incidentally mentioned in the foregoing. Dr. Lessing makes an important contribution to the discussion, through a summary (published by us to-day) of a report which he prepared two years since upon the instructions of the Chairman (Mr. Charles Hunt) and the Directors of the South Suburban Gas Company. The summary did not reach us in time to make careful study of its contents for the purpose of editorial comment; but in view of the meeting of the Institution this week and the current interest attaching to the subject, we have not delayed its publication.

Depreciation Allowance for Income-Tax.

INCOME-TAX returns for 1919-20 are now being made by gas undertakings; and there is a point which should be investigated, and upon which claims should be made. We have not seen a copy of the official instruction; but it is understood that there has been one issued which allows a 50 p.ct. increase on depreciation allowance for income-tax for 1919-20, with a credit for the difference paid on the 1918-19 returns. That is to say, the 10 p.ct. on the written-down value of cookers and meters has for 1918-19 and 1919-20 been increased to 15 p.ct., and the 3 p.ct. on the written-down value of gasholders to 4½ p.ct. From inquiries made of us, it would seem that some surveyors are allowing the additional 50 p.ct., while others do not appear to have heard of the instruction. However, it would be an advantage if an authoritative statement on the subject was issued; for in view of the increased costs involved by up-keep in these times, the extra 50 p.ct. is very welcome, although none too much.

To another matter bearing upon income-tax assessments attention is directed by a letter in our "Correspondence" columns to-day from Mr. J. E. Lister Cooper, of Yeadon. It refers to the allowance of one-sixth of the annual value, made to commercial undertakings, which does not at present extend to the gas industry. It appears that the Yeadon Gas Company have been pressing the question; and an intimation has just been received that, as the result of their negotiations and correspondence, a clause is to be inserted in the next Finance Bill authorizing the allowance. The gas industry having lost the benefit of the concession for one year owing to the wording of the original clause, it is extremely desirable that the promised clause should be carefully considered, in order that the undisputed and overdue claims of the gas industry may be safeguarded.

Reconstruction or Destruction.

WE are quite accustomed to the men of the electrical fraternity indulging in postulation for business purposes; and then, when challenged by those technically qualified to make a challenge, switching-off into a dead silence until they see fit, or think it is safe, to have recourse again to the same tactics. Postulation may succeed in netting the custom of lay folk who have no knowledge as to how to apply a test to prove the validity or invalidity of what is placed before them. Though there are electrical men who stoop to postulatory methods for securing business, we are surprised to find a Government Department deeming it necessary to pursue a similar course in support of the Government electricity scheme. This Government Department is the Ministry of Reconstruction; and reconstruction should not tolerate any such reactionary proceeding as the promotion of national waste. It is quite true that the Government are proposing to "reconstruct" the generation and distribution systems of the electricity industry. But the fact that the Government are doing this is no assurance that the extraordinary prophecies that have been indulged in are going to be fulfilled. We are absolutely convinced that they will not all be; we will go further and express doubts as to whether any substantial good will result, even in the power field, from the stupendous amount of work that it is proposed to carry out, under the conditions existing to-day. The postulatory statements of the Ministry of Reconstruction to which we take exception are found in one of their last-issued pamphlets on

reconstruction problems. It is No. 24, dealing with "Electrical Developments;" and some criticism of it will be found in "Electric Supply Memoranda" to-day. But we wish here to emphasize strongly the protest against a Government Department taking an attitude in the name of reconstruction that, if people place reliance in the declarations (and some will, as they are circulated with the imprint of a Government Department upon them), will tend to destroy some of the business of an industry that can demonstrate not only theoretically but practically its vast superiority over anything that can be done electrically in the matter of the utilization of coal for the provision of a labour-saving heating agent.

It does not appear to have occurred to the Ministry of Reconstruction that, if electricity possesses as a domestic agent all the superlative merit with which the pamphlet cloaks it, it would not need the witness of a public department to make it popular, and to rapidly extirpate all competitors. But it could not do so before the war; and it is not going to do so now. It could not do so before the war because gas proved its superior economy and efficiency; it will not do so now, notwithstanding electrical reformation and new construction, simply because the conversion of coal to electrical energy is such a grossly inefficient process for heating purposes. We cannot think the Ministry of Reconstruction is aware of the actual facts. But this is not owing to want of publication of such facts; and so it is either due to the ignoring of the facts, or to the Ministry being altogether oblivious of the truth of the matter. As we have said elsewhere to-day, the facts have been presented fully, and with clearness, in the report of the Board of Fuel Research, in Sir Dugald Clerk's Royal Society of Arts paper, in Professor Cobb's "Edinburgh Review" article, in the Cantor Lectures by Professor Bone, and in the case for the gas industry prepared by Sir Dugald Clerk and Professors Smithells and Cobb. Now to-day we have a supplement from Dr. Leonard Hill, F.R.S., in the shape of the lecture he delivered at the Bristol conference of the "B.C.G.A." Has not the Ministry of Reconstruction seen all this clear evidence which men pre-eminent in the science and art of utilizing fuel have advanced, and to which they have appended their names, with the view to controverting such scientifically unauthorized statements as we find in pamphlet No. 24, to the issue of which the Ministry has given its sanction, and therefore stands responsible? Is it true to say that the use of "gas for lighting undoubtedly increases "the burdens of the housewife?" It is not. Is it true to say that "every home may have its supply of electricity for "lighting, heating, cooking, cleaning, and even sewing?" It is not. Monetary considerations and the national interests in the matter of the conservation of coal prohibit the sacrifice of the heat energy of coal in the prodigal manner necessitated by electricity production and its conversion back again to heat, giving the user only an insignificant percentage of the original heat energy of the coal. How the Ministry of Reconstruction was beguiled into subscribing to such nonsense as is presented in the pamphlet in respect of heating we cannot divine. Electrically generated, too, is this gem: "Electricity offers the one form of heat that is "completely free from the production of dirt or any form of "noxious gas." What dirt and what noxious gas does a modern gas-fire emit? Perhaps the Ministry will kindly inform us. We also read: "For heating ovens, roasting, "and grilling, electricity offers, at a cost comparable with "other methods, results superior to any that can be achieved "otherwise." This is another demonstrable absurdity.

The makers and vendors of electric stoves could not possibly have done better in the way of advertisement than has been done for them by the Ministry of Reconstruction. If the Ministry did the right and fair thing, they would have an expurgated edition of the pamphlet prepared, and renounce the one already issued. The Government has been very successfully lured into wild extravagance by electrical influence, without surveying carefully the whole light, heat, and power situation in relation to coal conservation and the efficient and most profitable use of fuel, and without considering the position of the gas industry as a home producer of materials essential to other industries, and (as the war has shown) to home defence and to the prosecution of war. The pamphlet proves the completeness of this influence, and the great receptivity of the Ministry of Reconstruction of just anything that is sent to it through electrical channels. In this instance, the Ministry has totally missed its way.

Confirmation by Scientific Men.

Hearty welcome was given at the Bristol Conference of the "B.C.G.A." to Dr. Leonard E. Hill, F.R.S., who is world-famed in connection with investigations into the subject of heat and ventilation in relation to health. It is a far cry to the time when he formerly publicly appeared as an advocate of the gas-fire. His views in this direction are not founded on information picked up from any outside sources, but on personal research and experience, which make them all the more valuable. He is a strong believer in securing in heating, for health reasons, as near as possible natural conditions—radiant heat and motion of the air of a room—and, all the better, if these conditions can be economically realized. He finds the best instrument for these purposes is the modern gas-fire; and it has superiority to the coal fire because it is labour-saving, can be regulated, and in its use it does not create dirt and atmospheric pollution. A large part of his lecture at the Bristol Conference was directed to the question of economy in comparison with electrical means of heating—a subject which is of considerable national importance in view of the electrical movement that is now being made under the ægis of the Government, supported by the erroneous beliefs that have taken strong possession of the political mind, and which scientific men, knowing better, are endeavouring to dislodge. In his comparisons, Dr. Hill was too liberally disposed to the electricity industry, and not sufficiently generous to the gas industry. In reality, this makes his comparisons more unassailable, because he has a margin in hand between his figures and actual performance in both cases. For example, he stated that, to deliver to the consumer by means of the electric station the heat contained in ¼ lb. of coal, 5 lbs. of coal would be used at the worst electric station, and 2 lbs. at the best. There is not in this country an electric station in existence which generates a kw.-hour for 2 lbs. of coal; and the Coal Controller not long since showed that the worst of existing stations use, on the average, between 16 and 17 lbs. of coal to generate 1 kw.-hour. In other words, electricity is being generated in this country to-day at anything between close upon 2½ lbs. per kw.-hour and 16 and 17 lbs.—the bottom figure, of course, being in exceptionally fine electrical areas through the solidarity of the industrial demand. In another part of his lecture, Dr. Hill only took from 12,000 to 13,000 c.ft. as the gas product per ton of coal, which means that ¼ ton of solid fuel is still left for sale, besides tar and other valuable commodities. Against this, the gas industry has in hand the dilution systems by steaming charges or the admixture of blue (or slightly carburetted) water gas, which will give, say, from 8 to 10 million B.Th.U. in gas, compared with the 5½ millions which Dr. Hill takes as representing about average working under the older gas-making processes—of course, with, in the case of new practices, a diminution of the coke available for sale. This is the line of progress (incidentally mentioned in the lecture) upon which the industry is working; so that all Dr. Hill has to say regarding economy is subject to progressive improvement as the opportunity for carbonizing plant reconstruction or extension permits. To gas-works operations as to the heating problem, some words that Dr. Hill uses apply: "Sentiment "cannot defend colossal waste; custom must conform to "the nation's needs."

The Tangible Economies of Steaming.

This summer, despite the prices of materials and labour, there is going to be a large amount of reconstruction and extension work put in hand by gas undertakings. Necessity commands; and the necessity is not only due to plant conditions, but to working costs pressing for economical production. Many gas engineers to-day, working under the burden of heavy costs and high prices of gas, are very envious of, and want to be put into a position similar to, their *confrères* who find their producing costs considerably eased, and the price of gas only increased by a moderate amount, through the possession of vertical retorts which allow of the operation of charge steaming. Among those who have such retorts great enthusiasm is at work, engendered by the knowledge that they hold the means of largely countering the additional costs that have come upon the industry, and which, in places where plant has not the same inherent elasticity, have put an effective brake on trading progress. Plenty of information has already been published as to experiences by charge steaming; but we have before us now a number of returns supplying the latest

particulars as to what is being done—in this instance, the whole of the installations being of the Glover-West type. Now this batch of returns are of considerable interest, because they are made by the responsible engineers of works located in different parts of the country; and therefore with nothing in common beyond the settings themselves. In some cases, there are no other retorts in use; and the only gas that is being supplied is the mixture produced by coal carbonization and steaming. The supervision and the local conditions are not the same; and coals from different areas are used. Nevertheless, there is no variation of the tale in the returns. From all quarters are seen largely increased gas productions per ton of coal; coal savings, in relation to cubic feet or B.Th.U. produced, ranging from 30 to 61 p.ct.; more gas produced per retort and per man (which means saving of capital and labour charges); increased yields of tar and ammonia; and a condition as to inerts with which Sir George Beilby and his colleagues of the Fuel Research Board would be vastly pleased.

The returns are for periods of actual working, ranging from a few months to a complete year. It is clear that most of the engineers are regulating their productions to round about 450 B.Th.U. gas; and, according to the character of their coal, they are realizing from 18,000 up to 19,500 c.ft., while that exceptional and mysterious Uddingston has, with Lanarkshire washed nuts, reached, through the past five months' working, an average of 25,273 c.ft. of 460 B.Th.U. gas, which means 11,625,580 B.Th.U. per ton of coal, with 8·53 cwt. of coke for sale. Our "Miscellaneous News" columns to-day show that for the whole year ending April last an average of 23,580 c.ft. of gas were made per ton of coal carbonized; and 22,472 c.ft. were actually brought to account. The coke sold was 7·83 cwt.; tar, 21·6 gallons; sulphate of ammonia, 40·68 lbs.; and crude benzol, 1·43 gallons. Coming back to the returns, there is Macclesfield with various kinds of coal making, during three months, an average of 19,506 c.ft. of 458 B.Th.U. gas (8,933,748 B.Th.U. per ton); and over the four months' working up to February last, an average of 19,440 c.ft. of 460 B.Th.U. gas. At the Belgrave Gate works (no horizontals being used), Leicester in the second half of last year was making, with Derbyshire coal, 18,000 c.ft, of 450 B.Th.U. gas; and Nelson throughout the year to March last was producing 18,016 c.ft. of the same quality of gas. At the Gillingham (Rochester) works 16,754 c.ft. of 500 B.Th.U. gas has been made from (chiefly) Durham and Derbyshire coal; and even higher returns are expected when the steam is superheated. The returns include Blyth, Northampton, Wishaw, and Helensburgh, with makes varying from 15,000 to upwards of 16,000 c.ft., of between 470 and 506 B.Th.U. gas.

Having regard to the various qualities of coal with which these actual working results have been realized, there is quite good ground for expecting that, with a fair quality of coal, 20,000 c.ft. of 450 B.Th U. gas will become the usual practice, which would mean in gas 9 million B.Th.U. per ton of coal, as compared under ordinary practices with (say) 12,500 c.ft. of 500 B.Th.U. gas or 6¼ millions. On the latter lines, it means that 1½ tons of coal would have to be carbonized to produce the 9 million B.Th.U. realized per ton by the former system of working. Besides this saving of coal, there is the lower cost for wages, and the greater production of tar and ammoniacal liquor. Discounting the saving of coal, there is the additional expenditure of coke occasioned by the steaming system. But Uddingston reports 8·53 cwt. for sale per ton of coal, Nelson 8·26 cwt., and Leicester over 13 cwt., which last-named figure is a high one. Where an engineer is producing as many B.Th.U. in the form of gas from 1 ton of coal as he did before from 1½ tons, though he may have 1 or 2 cwt. of coke per ton less for sale, he is doing well, particularly with coal at current prices. Respecting labour, during a week in March at Leicester, the wages costs (including electric current) of coal from and including breaker to hoppers, and coke from settings, grading, and into hoppers, worked out to 1·38d. per 1000 c.ft. At Blyth, it is estimated that, on three months' working, there has been a saving in wages of £500. Wishaw reports a saving in carbonizing costs during 1918 of £1092. From Helensburgh comes the report that the wages bill for last year was only 16 p.ct. above the wages bill of the year 1913-14, and that the net cost of gas per 1000 c.ft. was only 1d. above the pre-war figure. From all other quarters, the information is given that the savings in carbonizing costs have been considerable. The yield of tar ranges between 15 and 24½ gallons per ton of coal—the highest figure being Uddingston, which also boasts an actual sale of 52·86 lbs. of sulphate of ammonia, modified by the year's average (as seen above) to 40·68 lbs. Macclesfield shows 30·5 gallons of 10-oz. liquor, Leicester 40 gallons, and Rochester 27½ gallons.

The effect of such working upon financial results, it is manifest, must be considerable. Nelson, as has been seen, is making 18,016 c.ft. of gas per ton; and for Nelson, last year (high costs notwithstanding) was the most successful one in the history of the undertaking. The net profit was £10,467, which the annual report attributes to a great extent to the large saving of coal effected by steaming—a saving of no less than 6000 tons. That labour charges have also been materially reduced is shown by the fact that the Nelson works were entirely closed-down; and the Brierfield works and retorts have been able to provide all the gas required during the period of maximum consumption. The Brierfield installation of vertical retorts, which formerly produced approximately 1,250,000 c.ft. of gas per day, is now capable with steaming of sending to the holders 1,800,000 c.ft. Coal and labour at present prices are worth saving. The effect is further reflected in the charges to the consumers. Despite the serious increase in materials and labour, the net price of gas to the ordinary consumer at Northampton at March last was 2s. 8·4d. per 1000 c.ft., which was only 6·4d. above the net price in July, 1914. At Helensburgh the price is 3s. 1½d. The charges to ordinary consumers are not stated in the other returns; but, from our own knowledge, the gas consumers in some of the places mentioned would have a painful shock if asked to pay the prices ruling in many towns where there is no opportunity for similar production of economy. Steaming has been making an effective stand against cost advances. What have the critics who are supplying to consumers, at higher prices per 1000 c.ft., less B.Th.U. for equal payment, to say to the tale presented by these fresh returns?

Poor Outlook for Cheaper Gas-Consuming Goods.

The outlook for cheaper gas-consuming appliances is not a rosy one. Up to May 1 last there were manufacturers in the gas industry who were paying 95s. per ton for pig iron, and are now faced with an advance to 165s. per ton for all deliveries. Further, they cannot contract, and so have to pay the day-to-day price. What is worse is that there is anticipation that the price is going higher still. We hope anticipation will not be fulfilled. The present rise in pig iron will make a tremendous difference to the cost of production.

Charging on the Heat Unit Basis.

Discussing this matter in an article in "The Times Engineering Supplement," the writer makes a point which we do not remember having hitherto seen discussed. He considers the effect of the heat unit system of charging by comparing the dearest and the cheapest gas supplied in London at the present time. One Company is selling approximately 550 B.Th.U. gas at 4s. 4d. per 1000 c.ft., whereas with another the price is 3s. 8d. for a gas of 500 B.Th.U.—a difference of 8d. Assuming the standard unit fixed was equal to 10,000 B.Th.U., the price per unit in the case of the 550 B.Th.U. gas would be 0·95d., and for the 500 B.Th.U. gas 0·88d. The difference between these prices per 10,000 heat units—0·07d.—appears to be insignificant, but it becomes very appreciable when gauged from the standpoint of cubic feet. This being so, the arrangement (the article points out) should be decidedly attractive to those who continue to make the more costly rich gas, or to those who have no facilities for adding combustible diluents either by separate plant or by steaming the charge. "In fact, in order that the disparity in the cost of gas of different undertakings might be more readily demonstrated, there is perhaps something to be said in favour of making the standard unit so large even as a million B.Th.U."

Not Much in the Idea.

Little can be said for this proposal, as the difference per million B.Th.U. between the two Companies only amounts to 7d., or actually 6½d. The 1,000,000 heat units of the 3s. 8d. gas would be exactly 2000 c.ft. costing 7s. 4d.; 2000 c.ft. of 550 B.Th.U. gas would cost 8s. 8d.—a difference of 1s. 4d. But there are 100,000

more heat units in the latter case to dispose of, which at 0·95d. per 10,000 would produce 9½d. Deducting this from the 1s. 4d. makes 6½d. as the difference per million B.Th.U. This is not so overwhelming as is hinted at in the article; it only shows still more clearly how the heat unit basis of charging would help to belittle the higher charge for the richer calorific power gas. There are undertakings that are steaming their charges—not in London—that are selling gas at below 3s. per 1000 c.ft. In these cases, the difference per million B.Th.U. becomes more marked; the price per 1000 c.ft. a greater attraction than 4s. 4d.; and the effect in gas-fires and gas-burners gives the consumer satisfaction. The economic value to the gas industry of lower-grade gas is not summed up by any comparison such as is made in the article to which attention is here directed.

The Report of the Board of Fuel Research.

The "Engineer" may always be relied upon to take a broad and fair view of the problems which the gas industry may encounter. It does so in these times when the industry is being simply stifled by the difficulties that have arisen during the war, and partial escape from which can only be by its release from restrictions fashioned in other times and under other conditions. Our engineering contemporary has been reviewing the proposals of the Fuel Research Board for enabling the industry to have a larger and more serviceable existence. It finds in the report cold comfort for those local authorities responsible for the testing of gas who have been clamouring for a return to the pre-war penalty system, and for the reinstatement of methods which were a direct obstacle to progress. The gas industry has for a century been fettered by the dictatorial policy of inexperienced laymen; and "it should at least feel gratified that its cause and aspirations have now been studied and reported upon by an impartial Committee composed entirely of experts on the question of fuel utilization." The industry is gratified, though it would like a little revision on one or two recommendations which rather spoil the main ones. The "Engineer" regards the report as favourable to progress along lines which will enable reductions to be made in the price of gas; and it appeals to Parliament to see that the recommendations are forthwith carried into effect.

Insurance of Workers.

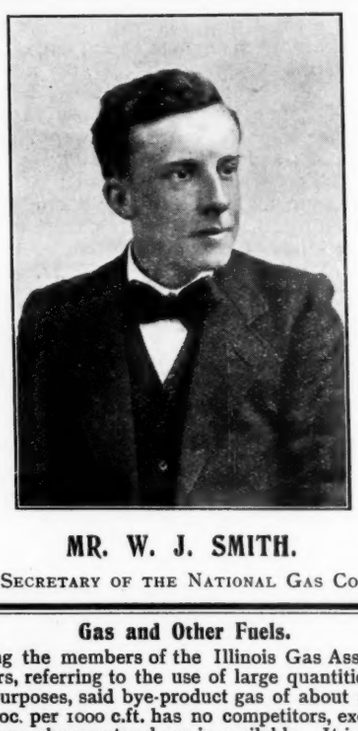
According to the "Daily Telegraph," an early announcement may be expected of the intention of the Government to raise the £160 limit of income which applies to persons eligible for national insurance. Some step of the kind is obviously necessary in view of the change in the value of money—a change which has already been recognized in the case of workmen's compensation. The probability is that both employers and employed will be called upon to make larger contributions, for which the State will provide an equivalent—thus ensuring that the scale of benefits shall correspond with present-day needs. A drastic amendment of the present Act cannot, of course, be entered upon until something is known of the insurance scheme against unemployment which is now under consideration by the Ministry of Labour. Sir Robert Horne contemplates the introduction of a measure providing for the insurance of workers in all trades; and the necessary inquiries (our morning contemporary states) are to be undertaken without delay, though it is not anticipated that the proposals will be ready for submission until the autumn.

Coal Output not Encouraging.

It was not a very encouraging announcement Sir Auckland Geddes made in the House the other night regarding coal output and supplies. He fears that the position is such that it will be necessary either to reduce the supply of coal to industries or to limit even more strictly the amount exported. A more definite statement, he added, was not possible until the actual effect upon output was known of the reduction of miners' hours. Without any shortage in the hours of work, the output per person employed continues to show a decrease. But surely now that more skilled men are at work, there is no reason why the total output should not have an upward tendency. However, it is hoped the Government will see that home industries have not this additional handicap put upon them. Better by far reduce the coal exported, and let a greater quantity of manufactured goods flow out of the country.

Benzol Propaganda.

The Automobile Association are going wonderfully strong on home-produced motor fuel. Meetings have been held at Maidstone, Exeter, and Guildford. The energies of the Association are being largely directed to benzol—the moving spirits being Major Stenson Cooke and his benzol expert, Captain Montgomery. The Association has formed a Fuel Department which is concentrating upon this subject. At the meeting at Guildford there were motorists and others interested in transport; and a resolution was passed which endorsed the views of the Fuel Research Board so far as benzol is concerned, urged that town gas should be stripped, and submitted the necessity of removing restrictions that at present hamper the manufacture of commercial alcohol for motor fuel. We are glad to have the help of our motor friends so far as statutory restrictions are concerned which, if re-established, would have the effect of largely preventing the recovery of benzol from gas. But it is hoped that it will not be understood at Westminster that the motorists approve of all the recommendations of the Board of Fuel Research. Some of the subsidiary ones the gas industry will need to have modified if the value of the main proposals is not to be substantially neutralized.



MR. W. J. SMITH.

The Secretary of the National Gas Council.

Gas and Other Fuels.

Addressing the members of the Illinois Gas Association, Mr. E. J. Caspers, referring to the use of large quantities of gas for industrial purposes, said bye-product gas of about 550 B.Th.U., at 35c. to 50c. per 1000 c.ft. has no competitors, except in communities where cheap natural gas is available. It is folly to compare this gas, on a heat-unit basis, with producer gas, coal, coke, or oil, because the efficiency of oven gas is so much higher than any of these other fuels that, when the final results are examined, it is found cheapest per unit of finished product. As an example, it takes seven times as much producer gas of 120 B.Th.U. as oven gas of 600 B.Th.U., where the over-all efficiency of the furnace is concerned; whereas, reckoned on a heat-unit basis, the 120 B.Th.U. producer gas would figure-out one-fifth as good as 600 B.Th.U. oven gas. The difference between practice and theory is that producer gas has about 65 p.ct. of inert gases which have to be heated to furnace temperature; and this heat is lost up the flue. Producer gas has only a small amount of hydrogen gas, which makes it difficult to ignite; while oven gas has a high percentage of hydrogen, which renders its combustion intense. Solid fuels have to be gasified before combustion can take place; and they cannot be burned unless an excess of air is admitted. It takes heat to gasify the coal, and to raise this excess air to furnace temperature. Oven gas can be burned with just the right amount of air. Fuel oil must first be atomized and then gasified before combustion will take place; and this absorbs heat. In average practice, it takes 10 gallons of 120,000 B.Th.U. oil to do the work of 1000 c.ft. of 600 B.Th.U. gas, though theoretically only 5 gallons of oil are needed.

American Gas Association Annual Meeting.—Oct. 13 to 18 is the time fixed for the annual meeting of the American Gas Association, which will take place in the Hotel Pennsylvania, New York. A special feature will be made of the exhibition of gas appliances and apparatus, exhibitors in which must be members of the Association.

THE INSTITUTION OF GAS ENGINEERS.

MEETING TUESDAY, MAY 27, 1919.

PRESIDENTIAL ADDRESS DELIVERED BY

Mr. SAMUEL GLOVER, M.Inst.C.E., of St. Helens.

GENTLEMEN,—It is the practice in the Institution for the President to give an address at the last series of meetings over which he presides; and, notwithstanding the fact that the President is inducted into office twelve months previously, the address has heretofore been spoken of as the "Inaugural Address." I think this arrangement of having the address at the end of the year of office may have been made by our forerunners so as to keep the President from the temptation of giving voice to any prophetic vision, of which he may think himself possessed, as to the future prospects of the Institution of which he for the time being is the head. This is, I think, a wise provision, as thereby we obtain work before words; and upon this occasion the President would have been quite content to allow the work done to speak for itself. However, the necessity has been laid upon him to provide a Presidential Address.

After such a period as I have had of official work for the Institution, it appears to me that the address could be more correctly termed a valedictory than an inaugural address. It will be necessarily somewhat historical; but if at the same time it can be indicative and brief, so much the better. It will be clearly understood that the Institution as a body is in no way to be held responsible for any opinions herein expressed.

It will be generally agreed by the members of the Institution that we live in stirring times, and that we have won-through (and taken no mean part in winning-through) a very long and stressful period. It appears to me that our industry is in a condition that can be likened to that of a good stout ship which has been in a hurricane—a long and very violent hurricane, with fog—that has tested and tried every quality of the ship and the ability and endurance of the captain, crew, passengers, and owners; and though we have won-through the great hurricane, there are yet breakers ahead, rocks and shoals to clear, currents to avoid, and uncharted seas to cross. Now we must set to work to find the true position of our ship; for we have been driven out of our course to some extent during the hurricane. We must get all our tackle and stores ship-shape again, including coals, generators, and all machinery—especially the steering gear—and making full use of all our practical experience, we must see how quickly we can arrive at the place whither we are bound, deliver the goods, and obtain returns.

THE NATIONAL GAS COUNCIL.

The question is being asked with some anxiety, "Are we in the gas industry on the right course?" I am convinced in my own mind that we are, and, withal, ready to make good progress. We have not only thought of, and talked about, reconstruction, but we have already carried through some work of reconstruction, and have now built-up upon a good broad foundation a National Gas Council which will, from this year, have every opportunity of proving its use to the whole industry, and, through the industry, to the nation as a whole.

As far as it has already gone, the realization of the scheme of uniting our forces is a practical embodiment of the ideas to which the late Mr. Edward Allen gave expression when he pleaded with those of us who were working with him for the setting-up of a United Council, representative and powerful, to guard and guide the industry to a larger and higher sphere of usefulness, and to a properly recognized position in the affairs of the State.

I confess that I cannot bring myself to agree with the view expressed by some of my friends in the Institution who say, "The pity of it is the Institution no longer represents the industry as a whole." After a long experience, it is quite clear to me that our Institution holds its present high position in the industry owing to the devoted way in which its members have done their work in the past; and I am convinced that it will continue its high service to the industry, and that it will be better supported with funds by which to carry on research work and conduct all kinds of practical investigations now that it forms part of an inclusive National Gas Council than in years past when it stood alone.

THE INSTITUTION.

However, the Institution of Gas Engineers continues to be the Gas Engineers' Institution; and it would be well if all the young men who are being trained in the industry, and who are hoping to take part in its work in the future, were to acquaint themselves with its history and work, and, in this way, more fully realize their rich heritage in this connection. Even a brief summary of the history of the progress in gas engineering would take too much time for inclusion in this address. A history has, however, been published recently of the work done since the founding in Manchester in the year 1864 of the British Association of Gas Managers, when there were 38 practising gas-works managers present. There have existed Associations of Gas Engineers and Managers under various names throughout the past 55 years; and to-day the total number of members of the various classes is close on 900. More are joining-up; and there is room and work for all.

As the Institution is sometimes spoken of as the "Gas Engineers' Trade Union," by a few who do not know the facts, I desire to take this opportunity of explaining that it has not been, nor is it, a Trades' Union in any degree.

To me it is apparent that it was early realized that gas manufacture would become a progressive science, and that co-operation in work and in developing ideas was necessary—isolation being bad for the individual, because it does not make for progress. Therefore it was decided by the early workers in our industry to exercise the highest prerogative of friendship—that of communicating to others all that had been found by each in practice to be most helpful. This continues to be the spirit in which the Institution does its work. No member, however high his attainments, professes that he knows all there is to be known. The last word on any of our many subjects of work and investigations has never been said; we are led on from more to more. I consider that Boards of Directors and Committees should grant every facility, and give every encouragement, to their responsible managers to secure their attendance at the Institution meetings, and their participation in its work.

SOME STATISTICS.

It might assist in the formation of more correct ideas of the importance of the industry which the gas engineering profession serves if the following statistics for the United Kingdom were here given. There are 831 authorized gas undertakings, of which 519 are owned by companies and 312 by local authorities. There are also some 800 non-statutory undertakings.

Total capital employed by authorized undertakings .	£140,000,00
Number of employees about	100,000
Annual wages bill upwards of	£20,000.000

The number of gas consumers is upwards of 8 millions, including 4,500,000 users of slot-meters. The total annual make of gas equals 250,000 million c.ft. The coal annually carbonized was approximating to 20 million tons, but has not yet reached this figure, owing to improvements which have been recently developed in the process of gas manufacture. The oil used annually for gas making is about 250,000 tons, when it can be obtained at a reasonable price.

After carbonization, there are left for sale about 9 million tons of solid fuel in the form of coke, 760,000 tons of tar, 170,000 tons of sulphate of ammonia, and another product which has not hitherto been given recognition in accordance with its importance—namely, sulphur, of which it is calculated the gas industry produces about 45,000 tons per annum in a form convertible into sulphuric acid. This 45,000 tons of sulphur would, if burned in suitable burners for the production of sulphuric acid, produce all the acid required for

the manufacture of the 170,000 tons of sulphate of ammonia mentioned.

The total amount paid annually in local rates by the gas industry is over £2,250,000.

The total number of cooking appliances lent to the people is upwards of 7½ millions, and of gas-fires 10 millions.

There are over 300 methods of applying gas to industrial processes, and more than 2700 trades in which gas is used in one or more processes—such as for annealing, brazing, hardening, tempering, melting, &c.

For those of us who are public lighting engineers as well as gas manufacturers, the following census (just recently taken) of lamps used for public lighting in 1000 cities and towns of Great Britain and Ireland shows that, of a total of 670,286 lamps, 585,550 are gas and 84,736 electric—giving a proportion of 87 p.ct. of gas-lamps as against 13 p.ct. of electric lamps used for this purpose.

The Industry's War Work.

In addition to this brief summary of our ordinary every-day duties, it has been suggested to me that there should be placed in the "Transactions" of the Institution a record of the industry's special war work in the production of benzol and toluol; and I take this opportunity of giving a few of the authenticated figures published in the "Gas Journal" of Feb. 11 this year, as provided by the Department of Explosives Supply, which was so ably controlled by our immediate Past-President, Lord Moulton.

The total production of benzol products from the industry during the war is given as:

Pure benzol	21,800,000	gallons approximately
,, toluol	8,000,000	,, ,,
,, solvent naphtha	4,000,000	,, ,,

As high explosives, the above quantity of benzol represents about 1,200,000 tons of picric acid; and the toluol corresponds to about 65,300 tons of "T.N.T."

The results of benzol recovery were not obtained in the same degree in all parts of the country, as is shown by the following figures, which are suggestive on several points:

North	1·00 – 1·50	gallons per ton of coal.
Yorkshire	2·00 – 3·00	,, ,, ,,
Midlands	0·80 – 2·00	,, ,, ,,
South	0·80 – 1·25	,, ,, ,,
South Wales	0·30 – 0·80	,, ,, ,,
Scotland	0·50 – 1·50	,, ,, ,,

Average over the whole, about 1 gallon of crude per ton.

The recovery of benzol from a normal coal gas reduces the specific gravity of the gas somewhat, and also the sulphur compounds. The calculated flame-temperature is not lowered. The effect of the removal of 1 gallon of crude per ton on the calorific value of normal coal gas is to bring about a reduction of 12 B.Th.U. per c.ft.

Benzol and Blue Water Gas.

If benzol is used to bring-up blue water gas to a good standard of useful value for a general gas supply, 1000 c.ft. of well-made water gas of 300 B.Th.U. can be raised to 430 B.Th.U. by 0·9 gallon; and, as 1 gallon of crude benzol equals about 35 c.ft. of gas, the volume would be increased by upwards of 30 c.ft. The conservation of coal can be secured by this system of diffusing the hydrocarbon vapours in normal coal gas among other gases, carefully prepared, of suitable quality and of sufficiently high calorific value. By these means, the percentage of impurities usually found in normal coal gas is reduced, and the percentage of inerts can be kept to a quite sufficiently low point. The gas so produced is of a more permanent character than the old-time vague mixture of hydrocarbons sent out as gas, and is therefore more likely to reach the consumer retaining the same quality and standard of value as when it was tested and stored at the works.

The Industry's Recognition.

We were informed by Lord Moulton that the quantities of benzol recovered by the gas industry during the war—more especially those secured early—made all the difference between a crippling shortage and an ample sufficiency which enabled the allies to win-through to the victorious peace of which we are only now beginning to be conscious.

We have been assured that, in the attainment of these results, and in the service thus rendered to the country and the allied cause, the industry has every reason to be proud. We accept the assurance with thankfulness that we in the industry were able to help in so high a duty. But we must not abide basking in the glory of this recognized achievement. Rather do we require to know what use is to be made of these new facts in judging the conduct of the gas industry. Are we, after having been paraded in an official cloak, to find that some unco-ordinated authority will come along and demobilize us, and disorganize the work we have accomplished in the interests of the gas consumer at large and of the nation as a whole?

I think, from what I have been able to observe, that there is a new spirit awaking in the minds of those called upon to judge in these matters; and that we shall find that something has been learnt during the war, and that the authorities have dignity enough, and sufficient intellectual courage, to enable them to admit this, and will (I venture to hope) amend and adjust our position by legislation in accordance with the new needs of the new times. The gas industry will, through its various organizations, continue to inform the public mind.

It is now recognized that the gas industry is a key industry of the first importance; and, in the forthcoming reconstruction of the industries of the nation, the carbonizing engineer will find more and more importance attached to his operations, to the raw materials he uses, and to all that he produces. Our Institution must be part of a national organization of science, to which Government Departments will continue to look for advice and practical help on the subjects upon which we are the nation's experts.

Legislation Affecting Gas.

We have been given to understand during recent months that the whole industry is in a molten condition; and it is to be hoped that it will continue in a state of flux, and never again be cast into such a clumsy and distorted figure as it has been in the past. To show the need for the formation of a more shapely future, I have had gathered together a summary of the Laws and Orders under which the industry has formerly been obliged to work. This summary is given as an Appendix; and the mere mention of the dates of the group of Acts controlling the manufacture, distribution, and sale of gas, which were passed so far back in the nineteenth century, suggests that they are not likely to be fitted to apply to this more enlightened twentieth century. The general position has not been redeemed by the passing of recent Acts and Orders; and the greatness of the reformation called for can only be realized after the shortcomings of the past are recognized in the light of a newly awakened spirit.

Legislation in future should be of such a nature as will set free the gas engineer from the inelastic bonds that have restricted his usefulness in the past; and, if he is to be looked to to assist in the conservation of the nation's coal resources, and obtain the greatest good for the greatest number of people from every ton of coal he handles as a gas manufacturer, he should be encouraged to produce the greatest amount per ton of gaseous thermal energy. Having done this, he will see to it (as he does now) that proper provision is made for all his consumers' needs of light, heat, and power, at a price for the whole service that will compete successfully with any public supply of electric energy, and at the same time provide reasonable and proper interest on the capital which has been devoted to the enterprise. If it is true that "the labourer is worthy of his hire," it is equally true that capital devoted to the establishment of manufacturing concerns is worthy of, and should be provided with, a proper scale of dividends. Especially is this so when the concern produces something which benefits the whole community, as does the gas industry.

Inadequate Financial Recompense.

It cannot be said of the gas industry, as it can of some other industries, that it has been profiteering during the war. As a matter of fact, both the authorities owning gas-works and the managing officials have been working throughout the whole period under adverse conditions imposed upon them from outside; nor have either of them been financially recompensed as they ought to have been.

Carbonization and Conservation of Coal.

The gas industry is charged with the important trust of dealing with about 17 million tons per annum of the nation's coal; and there are no other leaders of industry who have made the conservation of coal so serious a consideration as has the carbonizing engineer. To mark the distinct progressive advance made in the scientific treatment of coals in

gas making, it may be stated that, if to-day we were only making 10,000 c.ft. of gas per ton (and this was considered a good make per ton 25 years ago), we should have needed 7 million tons more coal last year in order to produce the output of gas.

When it is borne in mind that the Coal Control had not a sufficient supply of coals for all the home services and those of the allies, it may be imagined how much more serious the position would have been if the gas industry had been unable to carry on unless it had been provided with several million more tons of coal per year.

The Need for Suitable Raw Material.

Various phases of the coal question have been brought prominently before us in these latter months; but, while there has been a great mass of vague talk all round the subject, there remains one question that has not been debated with sufficient clearness to bring the truth to light. That question is, "What is coal?" I must not here enter into a disquisition on the subject of the organic composition of coals of various sorts; but, in passing, I will mention the microscopic sections I have had prepared for exhibition to you, in the hope that the subject may prove to be of more than passing interest to some. There are, however, a few plain truths which could be told by every gas-works manager. It is quite true to say that all is not coal which is sent up as coal from the pits. In fact, much of it is not even black. The screening and picking band equipment at many collieries is very deficient. In some districts there has been great lack of enterprise in the past with regard to the provision of sorting and washing machinery; and the gas engineer is quite determined not to allow the doings of the past with regard to the quality of coal to be established as an acceptable state of things.

The gas engineer is expected to keep inert matter out of his gas. But before any arbitrary standard is imposed on the coal user, he must be safeguarded by being provided with proper raw material—for the cleverest carbonizing engineer cannot produce gas or coke, or anything serviceable, from stones, roof, floor, or road dirt, of the presence of which there has been sadly too much evidence in coals delivered from some sections of the British coalfield. The cumulative losses entailed upon the nation through the sending-out of dirty coals have become a very serious total indeed; and the altogether too high proportion of these losses that the gas industry has been called upon to bear is only now beginning to be understood.

These and other hardships which have been imposed on the gas industry during the war have been the means of causing the industry to suffer distinct financial hardships which it would be to the nation's interest to have removed forthwith. In many places, where there is a suitable equipment provided, and proper control exercised, the quality and condition of the coal as delivered leave very little with which to find fault.

I am in hopes, however, that the subject of the treatment and the disposal of coals will be taken in hand, and that improvements will be persistently sought and quickly obtained. The subject of the quantity and quality of gas coals caused the late Sir Guy Calthrop much concern. It is to be expected that the Coal Controller will have coal to control in the near future, and that the great anxiety about a sufficient stock to balance the difference between deliveries to, and the requirements of, gas-works throughout the country during the coming winter will be met during the summer months, and that there may be no coal famine in the land.

The question is no longer one of saving transport somehow or anyhow; and in future our treasure of coal must be placed in the markets where its economic qualities can best be appreciated. For instance, there is a great deal too large a quantity of the nation's soft coals sold for use in open domestic grates and for other fuel purposes, while hard coals, with little volatile matter—such as ought to be classified as steam coals and house coal—are being sent to gas-works. The gas engineer is quite properly looking for a re-allocation of coals more in accordance with the nation's peace-time needs, which will show greater appreciation of the fact that there are coals and coals, and that a coal which may be quite suitable to be one man's fuel may not be at all suitable as another man's raw material.

There have been several schemes thought-out for controlling the sale and purchase of coal, enabling buyer and seller to take into account both price and quality in settling their contracts. I see no reason at all why such conditions should not be set-up in the gas industry in the future commercial reconstruction which, perforce, we must all help to bring about.

I am very anxious not to waste any of the precious time of this conference in mere recriminations; but it is necessary that our position as an industry should be made quite clear, and I think it will be agreed that the report recently written by members of the Institution in setting out the true position with regard to conservation of coal by proper treatment in gas-works is calculated to affirm our claims (along with the modern coke-oven manager) that we are true and faithful servants of the nation in so far as we are skilful coal carbonizing engineers.

The Gas Engineer's Control.

The gas engineer, after he has obtained his suitable coals from the nearest source of supplies of suitable sorts, has many exacting duties to perform and operations to control; and suitable staff, apparatus, and instruments must be provided in the future to enable the management to maintain better control of all operations—from the absolute control of the carbonizing heat applied to the coals under treatment within the retort, and the chemical control of all the operations of condensation, tar extraction, washing, scrubbing, purification of the gas, to the intelligent control of the whole of the consumers' apparatus. To all this must he see without neglecting the proper preparation and marketing of all the other main products—viz., coke, tar, ammonia, cyanogen compounds, and sulphur. In every branch of the whole cycle of operations there is pressing need for investigation and research work to be done. Is the Institution of Gas Engineers fully alive to its responsibilities in regard to all these matters? There are visible signs of animated existence to be observed, if one will take time to look.

Refractory Materials Research.

Take refractory materials, for instance. In the past, every manufacturer of fire-bricks and retorts declared that his goods were made of the most refractory material that had ever been discovered in quarry, clay hole, or mine. But many never submitted their goods to much trial by fire before sending them out as finished articles to expand, contract, or melt under the influence of someone else's fire. The Institution of Gas Engineers was the first to deal with this problem seriously and systematically, by means of a Managing Committee of Manufacturers and Users—combined in one common object—namely, research work upon refractory materials.

It can be asserted, without any exaggeration, that there has been considerable improvement in the materials provided by manufacturers as a result of the work done by our Institution; and whereas 2 p.ct. of expansion or contraction when in use was quite usual in the material generally supplied, the recent aim of the Committee has been to still further reduce the contraction from the 1 p.ct. already obtained to the ½ p.ct. of the future. The average by the best makers is already less than 1 p.ct.—a very considerable improvement, it will be admitted, in the control of a very important property; for, if a brick of low crushing strength tended to expand in a construction, and could not, because of the weight that it carried, it would disintegrate and lead to trouble. If any considerable percentage of contraction takes place, the whole construction is disorganized.

Fire-clay is a very vague substance; and it is very difficult to draw-up a specification of the quality of goods made from fire-clay, so much depending upon the physical condition of the substances in the compound, as well as upon the chemical composition. Under the wise guidance of Dr. Mellor (to whom the gas industry owes a great debt of gratitude), the Committee have achieved a definite material result in reducing the percentage of expansion or contraction—*i.e.*, change of size in use. All users of refractory materials may henceforth reap great benefit. This attainment is of itself a reward which more than justifies all the time and money spent by the Institution on the investigation. The industry was very much in need of guidance on this subject; for there is a considerable quantity of refractory materials required for gas-works purposes, and all this material should be of consistently good behaviour throughout its working life. Manufacturers of these goods are so convinced of the importance of having careful investigations to assist them to turn out excellent quality goods, that they are forming a Research Association of their own to work in conjunction with the gas and other industries. A further

report from your Joint Committee, which now has Mr. A. E. Broadberry as its Chairman, will be presented this session.

The many other subjects calling for careful treatment by the gas engineer can only be touched upon lightly in this address; but, as now we are all bracing ourselves to face a new and more prosperous future, each of us is either repairing, reconstructing, or extending the works under his charge, if not building new works. The attention of the most experienced among us is being called to the settlement of the question as to the best form of apparatus.

Condensation.

The subject of condensation is being viewed from quite a different standpoint from that of even a decade ago; and it is no longer necessary to take such tender care of our mixture of hydrocarbons and gas, for the gas that can now be delivered to the consumers' point of use is of a more permanent nature. Therefore, in modernized gas-works, the condensable hydrocarbons can be taken out by one operation as far as possible, and the operation controlled by the use of water-tube condensers of proper proportions and construction. The process of tar-extraction is more nearly completed by this method of condensing, so that the exhausters may not be called upon to knock-down so much tar usually carried forward as globules in the stream of gas. Exhausters should not be allowed to depend upon tar for the lubrication of their working parts, but should be systematically lubricated by means of purified tar-oils, the original cost of which is almost recovered as tar.

Ammonia Compounds.

The service rendered to the country by the carbonizing engineer in the production of ammonia compounds has been emphasized during the war. But the recovery of ammonia per ton of coal has proved to be disappointingly small in some gas-works; and it has been discovered by those responsible for accumulating statistics on this subject throughout the country that this low recovery result has been brought about in some of the smaller works through the management having been kept by its board or committee from spending money on condensers, washers, &c. We may, however, hope that, after the true position is realized, improvements will be made, old obsolete machinery replaced by new plant of suitable capacity for economical working, and proper enterprise shown. The subject of the construction and the working of mechanical washer-scrubbers, horizontal and vertical, would provide a study worthy of careful investigation by a Committee of the Institution; and one may, I hope, look forward to the day when all the apparatus for the mechanical treatment of gas will be housed under one roof and, to a large degree, delivered from outside influences, and so conditioned that all these inter-influential operations are under control.

When the proper quality of coals is supplied, the gas of the future will assuredly contain as manufactured a smaller percentage of cyanogen, a larger quantity of recoverable ammonia, a changed quantity and composition of tar and its low-boiling point distillates, and a controlled percentage of inerts, enabling the gas engineer to maintain the calorific value of his gas within reasonable limits to any standard he has undertaken to supply at a price. The problem of the removal of sulphuretted hydrogen on an economical basis having been solved, the industry desires to have set forth what has been found to be, in the wisdom of the most experienced, the model for a purifying house; and I would like to put to the brainy men of the industry the problem of providing an economical process for the production of a suitable quality of oxygen gas for use upon gas-works. It may be used to further increase the production of gas of high combustible quality per ton of coals, or certainly for use in the purifying process for revivifying *in situ* without the admission of any additional nitrogen.

The question of the extended judicious use of some of the ammonia produced in gas-making to assist in the work of purification, is one that might well repay careful investigation and practical experiments. The gas of the future will lend itself more readily to the "direct" methods of recovery of ammonia which will be present in the gas in larger quantities as the modern methods for the reconstructive distillation of coal are better understood and more extensively practised.

Consideration of these problems proves that there is a very close connection between research and industry; and there never will be an end to the problems requiring investigation in the gas industry so long as we have such a wonderful substance as coal forming the bulk of our raw material. The problem of the organic composition of coal is one that should receive earnest attention. Laboratory methods of examining all kinds of coals should be refined and extended, and the secrets—revealed in part by the microscope—probed into until they are fully revealed both from a scientific and a technical point of view.

Steel in Gas-Works.

The composition and behaviour of steel as used in gas-works apparatus—such as the floating bodies of gasholders, underground pipes, &c.—are subjects demanding attention from experts. Evidence is accumulating of the persistent tendency to disintegrate which is inherent in some of the stuff called steel used for rolling-down into gasholder sheets, thin plates out of which tubes are made, &c. It is quite evident that such "steel" has in its composition things other than carbon and iron. It may be that some of the impurities left in the metal are active chemically and electrolitically in the presence of moisture, and that this leads to the disintegration observed. However this may be, many cautious engineers are specifying for cast-iron pipes to be used where, for some reasons, they would like to have used steel if it had won their confidence. Some are looking forward to the day when there will be good old-fashioned wrought-iron in the market again. I am, however, warned by a very prudent engineer, who is handling large quantities of thin sheets, that the stuff which is being put upon the market as "sheet iron" is of mongrel composition, having some of the qualities of iron and some of those of steel, but with the defects of both. There is some encouragement to hope for better iron, and more of it in the future, in an address delivered by the President of the Staffordshire Iron and Steel Institution at Dudley on Oct. 19 last year, where he expressed his personal belief in "a great future for iron." Much interest is awakened on this subject through the research work which is being continued by your Committee along with the manufacturers on the subject of "The Life of Gas-Meters." A further report on the work of this Joint Committee will be presented to you during your present session.

Sulphate Stills.

The gas engineer, who is charged with the duty of manufacturing sulphate of ammonia, is called upon these days to see that a high standard of quality is maintained, and these conditions are likely to become more and more exacting. Care should be taken to see that the sulphate plant is kept up to its work in every way; and some manufacturers of plant for this work would be more likely to meet the needs of the future if they would revise their ideas of how an ammonia plant should be constructed. Stills are built-up in such a form as to prevent ready accessibility to their interiors; and some are not provided with sufficient head-room within the top chamber. Consequently, if foaming takes place in the still, liquor can too readily pass over with the gases into the saturator and discolour the batch of sulphate being made. The arrangements of the liming chamber and secondary still need to be much improved. Improved liquor separating devices should be adopted so as to prevent any tar (heavy or light) which may flow along with the liquor, from passing into the still. A simple contrivance should be included for insuring the production of a neutral salt without loss of ammonia; and it should be understood that there is a more exact standard wherewith to judge of a saturator than merely the total weight of lead that enters into its construction.

Tar-Distilling Works.

Only a few gas engineers are responsible for tar-distillation works; but every gas engineer should know more of the subject of what composes the tar he makes, and the control of its composition; and if any process is adopted to wash-out hydrocarbons from the gas into the tar, he should get the benefit of these, or if he causes these hydrocarbons to be diffused as vapours into a larger make of gas, then the quality of the tar made is varied. He cannot both "eat his cake and have it." His tar becomes a bye-product; but, whatever its composition as tar, he should make the best of it, and sell it as free from water as possible; and more pains should be taken to sell tar when tar is contracted for.

The Housing Problem.

The services of members of the Institution have been promised through your representatives on the British Com-

mercial Gas Association to those public bodies who are considering the great housing problem; and it is to be hoped that advantage will be taken of the gas engineers' experiences in the provision of facilities for the lighting, heating, and ventilation of every living room in every new house erected. There is reason to fear that modern houses are being planned by people who are not aware of the ventilating and general hygienic efficiency of gas lighting as against rooms lighted by electricity, in which there is no movement of the atmosphere—thus leaving the occupants literally "stewing in their own juice." It is understood that British manufacturers of all gas-using apparatus are looking for a radical departure from the old ruts, and are preparing to rise to the new occasion.

Industrial Gas.

The gas supply authorities are to be looked to in the future to be the suppliers of gas of various qualities for various industrial uses where, commercially, the circumstances justify departure from or addition to the present practice. This is a possibility which is of great future import to members of the Institution. Coke-oven gas, whenever it can be spared at the ovens, should be utilized by adjacent public gas supply authorities if it is made commercially possible so to utilize it.

To Conclude.

Time would fail me here to enumerate all the important work demanding attention in the immediate future by all gas supply authorities and their engineers; and some may already be saying to themselves, "Who then is sufficient for all these things?" The answer to this question is that only those are worthy and fit who are well schooled in the highest traditions and best practices of the past—be they directors, members of committees, or officials. The gas industry has performed a higher public service throughout its history than it has ever been given full credit for. There has been developed within the last decade or two an even greater desire within the industry to render a readier and larger service to the public; and there is great need for men of courage and right vision to guide the industry to its rightful position in the service and confidence of the nation.

> God give us men. The time demands
> Strong minds, great hearts, true faith, and willing hands
> Men whom the lust of office does not kill;
> Men whom the spoils of office cannot buy;
> Men who possess opinions and a will;
> Men who have honour; men who will not lie;
> Men who can stand before a demagogue
> And damn his treacherous flatteries without winking;
> Tall men, sun crowned, who live above the fog
> In public duty and in private thinking!

APPENDIX.

Laws Affecting Gas Undertakings, with Suggestions Thereon.

The laws which affect gas undertakings, whether in the hands of municipalities or companies, may be classified thus:

1. Acts which relate to manufacture, distribution, and sale.
2. Acts which regulate manufacture in gas-works.
3. Acts which contain protective provisions against damage to pipes.

There is further a group of Acts which relate particularly to the powers of local authorities as to the supply of gas and the expenditure of local funds.

The second group of Acts comprises Factory Acts, Workmen's Compensation Acts, Alkali-Works Regulation Acts, Public Health Acts (so far as they relate to smoke abatement), Petroleum Acts, and Rivers Pollution Prevention Acts. These Acts only affect the industry in common with other trades, and in so far as the manufacture of gas or bye-products brings a gas undertaking within their provisions. In other words, they are not particularly directed to the regulation of the gas industry. Whatever their shortcomings may be, therefore, the industry has no particular or special grievance with respect to their provisions.

The third group of Acts comprises the provisions which protect the pipes and mains of gas undertakings from damage, and the owners of pipes from inconvenience due to works of railways, telegraph, telephone, electric light, and tramway undertakings, and the use of road locomotives. It is probably true to say that the code established by these Acts furnishes on the whole well-defined and satisfactory protection to the interests of the industry.

It is to the first group—viz., those Acts which relate to the manufacture, distribution, and sale of gas—that attention might be profitably directed; and an examination of the position points to the necessity of a thorough revision of the law in this regard. The Acts in this group are:

The Gas-Works Clauses Acts, 1847 and 1871.
The Gas and Water Works Facilities Act, 1870.
The Sale of Gas Act, 1860.

Broadly stated, their provisions are as follows:

The Gas-Works Clauses Act, 1847, relates to breaking-up streets, conditions of supply, fouling water, financial provisions of maximum price companies, and several administrative matters.

The Gas-Works Clauses Act, 1871, relates to restrictions as to land to be used for the manufacture of gas, nuisances, amendment of conditions of supply under the Act of 1847, quality of gas, supply to local authorities, gas testing, recovery of gas-rents, legal proceedings, and various administrative matters.

The Gas and Water Works Facilities Act, 1870, sets up a code by which facilities may be obtained by Provisional Order instead of by Act. It has no application where it is sought to compulsorily purchase land. It needs no further comment.

The Sale of Gas Act, 1860, is referred to hereafter.

If the provisions of the Gas-Works Clauses Acts, 1847 and 1871, are compared with the text of a modern Gas Act, it will be seen that the latter contains provisions which are not in either General Act; and it will very probably be the opinion of the industry that this is an anomaly which should be removed.

It is true that the matters referred to are dealt with by clauses from the "Model Bill." But these only apply to an undertaking if they are included in the Special Act; and they are not automatically applied, as they would be if they formed part of a General Act to be incorporated in every Gas Bill.

The clauses from the "Model Bill" relate to the following (among other) important matters:

The General Powers of an Undertaking.—These clauses govern the powers of an undertaking both with respect to the maintenance of works and the manufacture of gas and residuals; and it will be recollected that, under the present form of clause, a limitation has been imposed whereby the power to manufacture residuals has been restricted. The mere fact that such a restriction has been imposed (due originally to the activities of the chemical trade), is proof that in such a vital matter the gas industry should be placed on a basis of greater security.

The Financial Provisions of Sliding-Scale Companies.—The powers governing the distribution of profits and the operation of the sliding-scale, the creation of Special Purposes and Reserve Funds, the carry-over, and the sale of stock and shares by auction are all based upon clauses from the "Model Bill." And again it will be agreed that this is a highly unsatisfactory position. On the other hand, the provisions of the Statutory Companies (Redeemable Stock) Act, 1915, do not apply to many gas undertakings, so that if a gas company requires power to issue redeemable capital, it is in many cases put to the expense of applying for special powers to enable it to do so.

The Method of Testing Gas.—The provisions for testing contained in the Gas-Works Clauses Act, 1871, are now an anachronism; so that the method of testing, the standard of quality, and the scale of penalties are dependent upon clauses to be inserted in each Act, and not, as it is submitted they should be, part of a General Act applicable to all gas undertakings.

There are many other important provisions necessary for the conduct of a modern gas undertaking, in respect of which an undertaking (municipal or company) has to depend upon the will of a Parliamentary Committee. Among these are the following:

Power to lay mains in private streets.
Power to allow discounts.
Power to purchase land by agreement.
Powers of charge for prepayment meters and fittings.
Power of control of pipes between main and meter.
Power to supply and let on hire, gas-engines, stoves, fittings, &c.
Notice required from consumer on removal.
Power to refuse to supply persons in debt for other premises.

Method of computing allowance in case of a defective meter.
Power to supply gas in bulk to local authorities.

All these matters are, it is true, sanctified by precedent, and are in the "Model Bill." But it is always open to an opponent to raise objections to their inclusion in an Act, or to exact terms for agreeing to their inclusion.

There are, however, other matters of necessity to gas undertakings, which are not even in the "Model Bill," for example:

Power to lay pipes for oil, &c.
Power to supply power gas.
Power to make differential charges for special purposes.
Conditions under which a stand-by supply of gas may be demanded.
Power to refuse a supply for non-domestic purposes if it would be injurious to the general interests of the consumers.
Attachment of brackets to buildings for public lighting.
Regulation of the use of gas-engines to prevent disturbance of general supply.

The final matter to which attention should be drawn is the fact that the provisions for testing meters contained in the Sale of Gas Act, 1860, are now out-of-date and quite unsuitable for modern requirements. There seems to be no reason why a modern testing of meters code should not be embodied in an up-to-date General Gas Act, and include provisions dealing with the measurement of gas supplied at high-pressure or in bulk, in both of which cases the use of ordinary meters (such as the Sale of Gas Act applies to) is either impossible or inconvenient.

The foregoing shows the need of an up-to-date General Act to be incorporated in the Acts of all gas undertakings and to cover all the facilities and protection required for modern purposes and for the future development of the gas industry.

Description of Micro-Preparations and Specimens to Illustrate the Organic Composition of Coal.

Prepared and Exhibited by Messrs. James Lomax & Son, of Bolton.

The illuminated frame contains sections made from portions of a seam of coal from floor to roof. These microscopic sections show the colours of the various bands, laminæ, and layers of the coal substance, and reveal interesting facts relating to the deposition and sequence of the plant remains, fructiferous organs, and other constituents forming the coal substance.

The two sides A and B contain micro-preparations from the same seam of coal—A containing preparations cut vertical to the thickness, or at right angles to the bedding planes; B preparations cut horizontal or parallel to the bedding plane. So that in the former the constituents are more or less crushed or flattened, appearing as bands and laminæ; while the latter show the constituents in the horizontal plane, which allows one with the aid of the microscope to determine the origin and species of various constituents.

The two series A and B are from a Yorkshire seam, A containing vertical preparations selected at regular intervals from the whole thickness of the seam, which is 9 ft. Therefore, the series is a representative series showing the various changes in the coal constituents throughout the entire thickness. The lowest section in the series is representative of the bottom portion of the seam; the middle coal, 4 ft. 6 in. from the bottom; and the uppermost, the top of the seam. The horizontal sections are from about the same zones of the seam shown side by side.

It will be found that the lowest or bottom section shows the coal constituents to be composed of finely-divided vegetable humus, with here and there bright looking bodies of a resinous looking nature. Ascending upwards in the seam the coal constituents gradually change, the evidence of vegetable remains becoming more pronounced and defined in shape and character until near the middle the coal is literally composed of the fructiferous organs of a lycopodaceous character (microspores and megaspores). From here upwards the preparations show that a change again takes place; the lycopodaceous remains gradually becoming less in quantity until near the top they are almost absent.

The above shows that the constituents in the lower part of the coal have been derived from a different class of plants from those in the centre, which suggests that a gradual development of plant life has taken place from one class to another until, as in the present instance, one class (lycopods) become in the middle predominant, crowding out all others until they become so rank as to degenerate and die off, giving place to others in many cases similar to those found in the bottom portion of the seam.

The succession is somewhat in the following order:

1.—Fine laminæ. Coal soft.
2.—Fine laminæ with resinous bodies. Coal soft and bright.
3.—Finely laminated bright coal with here and there resinous laminæ and spores.
4.—Semi-spore coal, laminated leaf-like humus with resinous bodies.
5.—Soft spore coal, highly laminated.
6.—Dull and tough spore coal.
7.—Spore coal, rather soft, with much fusain or mother of coal.
8.—Soft bright coal, with few spores.
9.—Soft bright coal, with resinous bodies.
10.—Soft bright coal, with resinous bodies and fine laminæ of leaf humus.

From here the coal becomes bassy, full of dirt or mud, until the ordinary roof or mud-stone occurs.

The above gives a general idea of the composition of a seam, such as shown in the apparatus; the colour denotes, as well as the constituents, if a seam is good for one purpose or for several.

The other side, C, contains a number of vertical and horizontal sections of coal from the most volatile through to anthracite.

The microscopes are provided to show sections of the various constituents to be found in coal.

Specimens of a portion of a seam of coal are exhibited which show a number of petrifactions cemented together by coal or primarily vegetable pulp. The petrifactions contain both whole and fragmentary plant remains, with their tissues perfectly well preserved in a matrix of carbonate of lime. It will be seen that by some means one portion of the vegetable humus has been petrified while the other has been converted into coal. Sections from some of the petrifactions found in coal are also shown.

In the case will be seen a number of stems, fruits, seeds, &c., from coal and petrifactions with all their tissues preserved almost as perfect in shape as when growing millions of years ago.

Increasing the Capacity of Mains.

Writing in the "American Gas Engineering Journal," Mr. A. C. Howard, of the United Gas and Electric Engineering Corporation, emphasizes the great advantage in the direction of increased capacity that is gained by feeding gas into a low-pressure system at several different points. By so doing, besides greatly reducing the size of low-pressure pipe required, the variation in pressure can be maintained at a minimum which could never be even hoped for in a straight low-pressure system without a tremendous investment in mains. He takes as an example a 16-in. main five miles long from the works to the last consumer fed by the works governor only, and the same main with gas admitted at two points. In the first case, supposing the main is fed with a station governor pressure of 4 in., then if the minimum pressure at the other end of the main is 2 in., gas will be delivered to the extreme point at the rate of about 26,000 c.ft. per hour. Should the main feed numerous services fairly evenly distributed over the five miles, it will, under the same conditions of pressure, take gas from the works at the approximate rate of 46,000 c.ft. per hour. With 8 in. pressure at the works and 4 in. at the extreme end, the hourly rate, with openings along the entire length, will be 65,000 c.ft. With two inlets, one at the works and the second $3\frac{1}{3}$ miles away, and gas being used uniformly over the entire length, the total hourly rate of delivery over the five miles is calculated to be: With a pressure at the inlet 4 in., and $1\frac{2}{3}$ miles from the inlets 2 in., 240,000 c.ft.; and with a pressure of 8 in. at inlets, and 4 in. $1\frac{2}{3}$ miles from the inlets, 336,000 c.ft. Thus, over five times as much gas can be delivered with equally good service when two inlets are used.

MAJOR BYWATER'S NEW POST.

ONE of those interesting little functions that are so often fraught with great personal significance took place at the Central Station Hotel, Newcastle-upon-Tyne, on Thursday last, when a number of representatives of collieries, &c., with whom the South Metropolitan Gas Company have business relations were invited by the Chairman (Dr. Charles Carpenter) "to luncheon with Mr. James Elliott, and to meet Major F. J. Bywater, M.C., the Company's newly appointed representative." It will be as gratifying to Major Bywater's many friends in the industry as it must be to him to know that this new appointment is to an independent position of great trust; they will share with those who have selected him for the post most complete confidence he will worthily fill it.

Mr. James Elliott is the principal of the firm who have for many years been acting as the South Metropolitan Gas Company's Agents and Representatives in the Newcastle district; but unfortunately age at last compels him to give up his work. During the luncheon—at which both Dr. Carpenter and the Secretary (Mr. F. M'Leod) were present—occasion was taken to do further honour to Mr. Elliott, by making to him a presentation on behalf of the Directors of a piece of plate, as a memento of the long and pleasant business relations that have subsisted between him and the Company. There were hearty and unanimous wishes that he may live long to enjoy the retirement to which his useful work in securing supplies of coal for the Company so thoroughly entitles him.

Major Bywater, who is to be Mr. Elliott's successor, was, it will be remembered, the Engineer of the East Greenwich works of the South Metropolitan Gas Company at the time of the outbreak of war; but he was one of the very early ones to answer the nation's call. Originally he joined a Line Regiment, but was afterwards transferred to the Royal Engineers, with whom he did excellent work in France, being decorated with the Military Cross. No doubt, the experience of organizing he has gained while with the army will serve him in good stead in the management of a branch of the Company's business which becomes of more and more importance, both from the point of view of securing the increasingly large supplies of coal and of controlling the growing number of ships now owned by the Company which carry the coal to London.

PERSONAL.

The name of Alderman Sir HALLEWELL ROGERS, M.P., the retiring Chairman of the Birmingham Corporation Gas Committee, was among those who were to be presented to His Majesty King George on the occasion of his visit to Birmingham; but Sir Hallewell was not able to be present, being away for the benefit of his health. Alderman GREGORY and Councillor SIMPSON, the Joint Secretaries of the Gas Workers' Union, were presented.

Mr. H. C. WIDLAKE, of the Plymouth and Stonehouse Gaslight and Coke Company, has been elected an associate member of the Institution of Electrical Engineers.

The Walsall Corporation Gas Committee have appointed Mr. JOHN W. HALSTEAD (the Works Superintendent) Assistant Engineer and Manager of the gas-works.

Mr. C. HARRIS, the Works Superintendent of the South Shields Gas Company, has been appointed Manager and Secretary of the Taunton Gaslight and Coke Company. Mr. Harris, who is a double medallist in the City and Guilds Gas Examinations, is a son of Mr. J. A. Harris, the Engineer, Manager, and Secretary of the Great Wigston Gas Company.

Mr. P. T. ROONEY, of Newbridge (co. Kildare), has been appointed Gas Manager at Strabane (co. Tyrone).

OBITUARY.

Mr. S. SAMPSON, of Prospect House, near Alfreton, died at his residence on the 23rd inst., after a short illness. He was deeply interested in gas matters, having been a Director for 40 years and Chairman for 38 years of the South Normanton and Blackwell Gas Company, Ltd., and Chairman for 15 years of the Alfreton Gas Company.

The death is announced in the "Journal des Usines à Gaz" of M. LEROY, for some years past Honorary Manager of the Paris Gas Company, and for many years a prominent and esteemed technical authority in French gas circles. Educated at the Mulhouse School of Applied Science, M. Leroy's early experience was in engineering. He became connected with the Paris Gas Company in 1871, and became Manager of the Belleville works in 1879, and of Passy in 1880. A short time afterwards he took charge of the Vaugirard works, a position which he retained until 1903, when he assumed the management of the Clichy works. He retired in 1910, and was appointed Honorary Manager, in recognition of his valuable and loyal services.

GAS IN MODEL HOMES.

THE housing question is much to the front just now; and gas engineers who are wishful of studying suggestions for dealing with the problem will have an opportunity of doing so while in London this week for the Institution meeting.

In the Central Hall, Westminster (not more than a minute's walk from the magnificent building in Great George Street of the Institution of Civil Engineers), the "Daily Express" and the "Sunday Express" are holding a Model Homes Exhibition, in connection with which they have enlisted the co-operation of the architects and home-planners of the country. Premiums amounting to 1500 guineas were offered for the best types of houses for unskilled labourers, skilled artizans, and clerical workers. Models of all the winning houses, and of other designs of conspicuous merit, are to be seen in the exhibition, in conjunction with the plans. Other models on view have been made to the standardized house designs approved by the Local Government Board.

The gas engineer has, of course, a large direct interest in the housing question; for he is able to offer the lighting and heating service which is most efficient, and best in every way for the purpose. This being so, one expects to see gas represented in the exhibition—and it is. The British Commercial Gas Association have a pretty little display, which at the time of the writer's visit was attracting so much attention that he had to wait his turn for an opportunity of closely inspecting it. The exhibit is a handsome model, tastefully mounted, and well lighted, of a prize-winning cottage under the Local Government Board competition. It is built to scale, and is an all-gas house—*i.e.*, it is installed throughout with a modern gas installation suitable for the type of cottage, each piece of apparatus, like the cottage, being correctly made to scale. It illustrates gas lighting, gas cooking, gas heating, gas water heating, and gas refuse destruction. The Davis Gas-Stove Company have a stand on which they show a very good selection of their gas-heated apparatus for national housing. The Parkinson Stove Company, in addition to showing a range of geysers for instantaneous water heating, make a special feature of their "New Cottage" water-heater, which was illustrated and described in a recent issue of the "JOURNAL." This heater was designed particularly to meet the demands of modern housing schemes. The Richmond Gas Stove and Meter Company also display a quantity of apparatus of a character highly appropriate to the objects of the exhibition. Among other exhibits bearing on lighting and heating is an automatic metallic-spark gas-lighter, shown by the Shoot-a-Lite Syndicate. This is claimed to be a highly economical and effective appliance.

Coke-Ovens for Town Gas Supply.

About eight years ago, says Mr. Edward H. Bauer, of Providence (R.I.), in an article contributed to the "Gas Age," men connected with the gas profession in the United States were watching with great interest the development of the Dessau vertical retort plant which was then being put into operation at the new coal-gas works of the Providence Gas Company. This installation—the first of its kind in America—furnished the coal gas required for the city, and was the foundation of further vertical retort schemes. It has now been replaced by a new coke-oven plant, with a nominal capacity of 7½ million c.ft. of gas per day, and consisting of a battery of forty bye-product ovens, with complete coal-handling conveyors, crushing and mixing apparatus, and bins for preparing the coal, a 750-ton coal-storage bin, quenching station, coke-handling conveyors, and both metallurgical and domestic coke-screening stations. The ovens are heated by producer gas furnished by a plant of five Hughes gas-producers of a capacity of 14 million cubic feet of gas per day. The gas is cleaned by passing through a plant designed by the Steere Engineering Company, of Detroit. The ovens were designed and built by the Koppers Company, Pittsburgh, and are known as their combination cross regenerative bye-product coke-ovens. They are so constructed as to allow of heating by gas made in the ovens themselves or by producer gas; or one part of the battery may be heated by burning its own gas, while the other part is using producer gas. Each oven is approximately 40 ft. long by 17 in. average width; and the design is for a fifteen-hour coking time of a charge of 11·4 net tons of coal. The producer gas, after leaving the cleaning plant, is delivered into a 10,000 c.ft. holder, which serves as a pressure-regulator only, and floats on the gas-main leading to the ovens.

Coal Industry: Dangers of Nationalization.—Anyone desiring to get a broad insight of this question in concise readable form should obtain from Messrs. Longmans, Green, and Co., of 39, Paternoster Row, E.C., a copy of a pamphlet written by Mr. Harold Cox, the Editor of the "Edinburgh Review." The price is only 6d.

Natural Gas Supply of Calgary.—A report is in course of preparation on the subject of the natural gas supply of Calgary, with an investigation into the prospects of a continuance of the supply, both at Medicine Hat and at Bow Island. The service and conditions of every town and city on the southern field were inquired into; and private consumers, both large and small, were visited in several places.

ELECTRICITY SUPPLY MEMORANDA.

In their first references to the Electricity Supply Bill, our electrical contemporaries are extraordinarily economical in the expression of their views. They were then probably waiting to see which way electrical opinion generally would line-up, so as to be on the right side. The "Electrical Review," "Electrician," and "Electrical Times"—the two former on May 16 and the latter on May 15—devote their editorial exercises mainly to sketching the contents of the measure. The "Review" finds in the Bill many evidences that the draftsmen have profited by the criticism which has been levelled at the Bill, and by the suggestions which have been put forward from so many sources. On the other hand, the "Electrician" appears to be relieved over the fact that there will be no more fruitless criticism and counter-criticism of the reports of the Government Departments; but it believes the drafters of the Bill have honestly tried to legislate as equitably as the complex state of affairs would allow. The "Electrical Times" (which refers to the "omnipotent" Electricity Commissioners) says:

The Electrical Press and the Bill.

> We imagine that the Bill will receive a good reception in electrical quarters. It might so easily have been worse. It is, of course, a half-way house to nationalization; and there is a strong body of feeling in the electrical industry adverse to such a departure. But that is a big matter. The Bill is before Parliament for good or ill; and it will emerge, modified perhaps, as an Act. If worked in the right spirit, it ought to extend and cheapen the supply of electricity in this country. The preliminary stages need careful handling in order not to check demand while big plans are being matured. The provision of Treasury money for this purpose is all to the good. It is a great thing to have the distribution left to the present undertakers; they are sufficiently numerous, and of convenient size, to maintain direct relations with their public, and to try-out all new expedients and devices for extending business.

There seems to be some doubt in these phrases as to whether or not the Act is going to work out to the good of the industry. It appears, in the judgment of our friend "Meteor," to be a question of whether the "right spirit" is brought into play. In our opinion (as has been shown in Editorial and "Memoranda" comments in the last two issues), there are other material factors which will bear upon the position, and the influence of which all the "right spirit" that may pervade the Electricity Commissioners and District Boards will not be able to resist. Still more doubt is suggested by a bundle of "ifs" to which "Meteor" has recourse.

> If the Commissioners will give plenty of freedom to the District Boards, if these in turn will encourage and co-operate with the undertakers, and if the existing stations are not prematurely scrapped in favour of giant power-houses, we do not see why the electric supply industry should not expand rapidly and without any temporary halt due to the change-over. It has to be remembered that capital costs on projected stations are now twice or three times the pre-war figures; and that gives the more modern stations equipped during the cheap years preceding the war an extended lease of life, because against higher running costs they can place much lower capital charges, while avoiding the heavy expense of transmission from external sources.

Our contemporaries are well pleased over the provisions as to overhead wires, wayleaves, and compensation to officers, as well as the one permitting the hiring-out of electricity appliances.

From Board of Trade to Ways and Communications.

As to the transfer of the powers from the Board of Trade to the Ministry of Ways and Communications (to coming under which Department the electricity industry has expressed a holy horror), the "Review" comforts itself with the thought that the Minister will be as able as the President of the Board of Trade, and as well disposed towards electricity supply. But "it is impossible to suppose that, in the stress of organizing a new department with enormous responsibilities, he will be able to devote attention to the subject, which must not wait, but is pressing for immediate action. The fact that the clause empowering transference is placed at the end of the Bill, 'Meteor' thinks shows that the drafters have clearly contemplated the chance that Sir Eric Geddes may not get his way." We rather think the position of the clause is due to the fact that it was put there at the last moment to carry out the intentions of the Government as originally included in the Ways and Communications Bill. The "Electrician" is of opinion that now it is known that Electricity Commissioners and District Boards are to be appointed, and the scheme in outline has been formulated, the actual Minister in charge becomes a consideration of quite different importance.

Not Much Room for Reducing Production Costs.

The paper which Mr. J. Somerville Highfield, M.Inst.C.E., M.I.E.E., read before the Society of Arts on May 7 is now before us in complete form. One of the intentions of the author was to do something to clear from the public mind certain of the fruits of that hypocrisy and deception to which it has been so freely treated, as to the electrical scheme of the Government flooding the country with electricity at a price which would enable all and sundry to abandon themselves to its use without fear of pauperizing themselves. Mr. Highfield is an electrician who believes in being honest, even if one's personal interests induce a little bias. There are a few points in his paper which may be noted in addition to those alluded to last week. It was not with him a question as to thermal efficiency; but an examination of the situation with the view of showing that fuel economy alone is not the one dominating item in the cost of the product. There are other items that are actually more important; and this is recognized when it is remembered that the capital charges usually represent about 50 p.ct. of the total cost of supplying a consumer with electricity—in some cases it is rather higher, in other cases somewhat lower. The average cost of connecting a consumer, including the service, meter, and proportion of the distribution main, is about £25. The coal bill represents approximately 25 per cent. of the total charges to the consumer, and the other charges the remaining 25 p.ct. Mr. Highfield shows that the incidence of these charges varies with the class of load supplied as follows

Total capital charges	from	30 to 60 p.ct.
Coal	„	55 to 10 „
Other working expenses	„	15 to 30 „

Having regard to the fact that the distribution capital represents approximately 50 p.ct. of the total capital employed, and that the cost of transformation, distribution, and maintenance of meters accounts for some 20 p.ct. of the total cost, it follows that no decrease in the price of bulk supply by super-stations or otherwise can possibly result in a very large reduction in price to the ordinary small consumer. The conclusion has also been reached by Mr. Highfield that, under the best conditions, the cost of transmission for distances exceeding twenty miles is a serious item. In his opinion, too, the greatly increased cost of plant and mains must mean that the superseding of existing plant will be delayed. It is further evident he does not believe in overhead trunk mains for carrying large power loads, as they are less reliable than underground lines, and alternative routes would be advisable. Evidently Mr. Highfield has lost patience with the electricians and politicians who have been trying to dope the public with their fabrications. "Much nonsense," he says, "has been talked about the universal use of super-stations, as though it were necessary only to erect a sufficient number to produce an electrical millennium." He is not a lover of financial assistance from the State. It should be rendered only when absolutely necessary; and, as far as possible, regard should be had to ordinary commercial requirements—that is to say, the money should be laid out so as to bring in a proper return. In the discussion, we notice that one speaker has found Sir Dugald Clerk's Society of Arts paper "most entertaining," but did not venture upon a criticism of the figures. Another speaker asserted that in cooking 39 electrical units would do the work of 1000 c.ft. of gas—that is to say, the expenditure of 133,380 B.Th.U. produced electrically would do the work of half a million B.Th.U. produced by gas. If this is so, then the electrical appliances used would have to be wonderfully efficient, and the gas appliances disreputable examples of their kind. Would the speaker be prepared to justify his statement in a public test with a good forfeiture attached to the losing side? Remember that, from the point of view of efficiency, no sane electrician claims 100 p.ct. for electrical appliances; so this makes the efficiency of the gas appliances extraordinarily low.

Government Advertisement.

The twenty-fourth pamphlet issued by the Ministry of Reconstruction deals with "Electrical Development;" and it would be interesting to know who authorized the issue by a Government Department of a statement of this kind, which is distinctly detrimental to an old-established industry such as is gas supply—an industry that has been and is rendering large service to the country, is a big tax and rate payer, is a competitor of electricity for light and power, one that uses coal with a high thermal efficiency compared with which the use of coal for producing electricity for heating purposes is sheer, prodigal waste, and one that supplies products essential for other industries. In the great reconstruction problems, the gas industry has a large part to take; and there is not the slightest justification for the Government or any of its departments supporting one industry in the manner they are doing to the detriment of another, to which, moreover, while draining it during the war, they have offered no material succour since. From the evidence that has been advanced now from many quarters, it is clear the Government in this electricity development scheme of theirs are simply pursuing a will-o'-the-wisp; and extraordinary things are proposed to secure remarkably low profit. In this pamphlet, we get the old tale of industrial wonders going to be achieved if power can be produced abundantly and cheaply. With this development of electric power, we are also informed there would appear to be "no valid reason" why the use of electricity for lighting and heating should not be widely extended, and why electricity should not be generally supplied in the homes of the people. There is a very valid reason—to be found in Sir Dugald Clerk's Society of Arts paper, in Prof. Bone's Cantor Lectures, in Prof. Cobb's "Edinburgh Review" article, and in the coal conservation report which has been prepared for the Institution of Gas Engineers by Sir Dugald Clerk, Prof. Smithells, and Prof. Cobb. In these documents, the Ministry of Reconstruction should be able to find ample material for discovering in the gas industry enormous

scope for some real reconstructive work, and at the same time helping coal conservation, instead of publishing a pamphlet putting forward such an *ex parte* case as the one before us. In it we also read: "The use of coal for domestic heating and of gas for lighting undoubtedly increases the burdens of housewives." The most economical light is the inverted incandescent gas-light; and for the eyesight it is infinitely superior to the high intrinsic brilliancy filament of the electric incandescent lamp. And using gas from which the illuminating hydrocarbons have been partly removed, the disadvantage hinted at in the quoted paragraph is also neutralized. In other words, gas lighting to-day has considerable advantages—economy of money and quality of light—over the electric light; and these are a good set-off to the one advantage of electric lighting of being convenient. Further on, we read that "every home may have its supply of electricity for lighting, heating, cooking, cleaning, and even sewing." The Ministry of Reconstruction has much to learn if it is going to perform its functions to the real advantage of the country; and we sincerely recommend it to a course of study of the documents referred to. It has also to learn that the City of Winnipeg is not comparable with this country, that what a large plant with a concentrated industrial demand can do in low fuel costs (which are only a small proportion of the total costs) is not what can be done generally in the country, and that many competent electrical engineers see no "valid reason" for supposing that power costs are going to be materially reduced below pre-war costs, in view of the expense that will now be involved in carrying out the Government programme.

Electric Furnace and Energy Costs.

Steel makers have been saying some very direct things to the electrical engineers, at a joint meeting of the Iron and Steel Institute and the Institution of Electrical Engineers, regarding the future of the electric-furnace. During the war the electric-furnace had a fillip; and electrical engineers became unduly elated—as one speaker said, they suffered from "swelled-headedness." Now the war is over, the steel makers are telling them that, except for very special purposes, the progress of the electrically heated type of furnace will depend upon the cost at which energy is supplied. And electrical engineers are now a bit downhearted when they hear the steel people talking of figures which, with costs of material and labour at what they are, they see no hope of reaching, if profit and not loss is to attach to them. At the joint meeting, several papers were read on types of furnaces and practices. The steel makers' idea as to the furnaces that claim adoption is that they are as much alike as peas from the same pod; and their virtues have very remarkable equality. We gather from one of the papers that in the United Kingdom some 141 electric-furnaces have been or are being installed, and that of these 117 are steel furnaces. Assuming these furnaces are worked at full load, the total nominal output per annum would be 405,000 tons. In the discussion, the electrical engineers were asked to supply furnaces that are metallurgically sound, and that do not require electrodes. Another speaker pleaded for simplicity, as development appears to be treading the path to greater complication. There is difficulty, too, with electrode supplies. Summed up, what the steel makers want is that the price of current, the price of electrodes, and the price charged for royalties by "so-called" designers shall be reduced. The cost of electrodes appears to be very high; and as to energy, this country cannot hope to compete with Sweden and Canada. It was Sir Robert Hadfield who pointed out that in Canada the cost is only 10s. to 12s. per ton of electric steel, as compared with £2 5s. to £3 per ton in this country. If electric-furnace progress is to wait until energy costs no more than it does in Sweden and Canada, then the progress will not be rapid, and the application of the electric-furnaces will be limited to very special work. Electrical men are not altogether sure that, with all they can do now, they will get back even to pre-war charges. The outlook for the steel-furnace has become a bit clouded.

Present Practice in Ammonia Washing and Oxide Purification.—Herr K. Liese, in the "Journal fur Gasbeleuchting," Vol. LXII., pp. 113-19, had an article on this subject which is abstracted in the current issue of the "Journal of the Society of Chemical Industry." The author points out that the ammonia washing process may be either chemical or physical. Physical washers include the normal tower scrubber and the various types of mechanical and centrifugal washers. Chemical washing includes the so-called "direct" processes in which ammonia is absorbed from the crude gas by sulphuric acid, as in coke-oven practice and "simultaneous" processes in which ammonia and hydrogen sulphide are removed together. The author considers that physical processes both now and (so far as can be seen) in the future will hold the field in gas-works practice, in which absolutely reliable, efficient, and continuous operation is essential—the requirements on coking plants being regarded as less stringent. The tower scrubber is still thought to be the most satisfactory plant. In the author's experience, trouble due to the formation of accretions among the upper tiers of the filling of scrubbers can be avoided by placing on the topmost hurdle a layer of wood-wool about 18 in. thick. The filling is kept clean; and the wood-wool requires renewal about once a year. Wash-water is fed through a pipe fitted with a spraying jet and sliding concentrically in a stuffing-box through a larger pipe which is fitted with a full-bore tap. In case of stoppage, the jet can be withdrawn.

THE SOUTHERN ENGINEERS AT MAIDSTONE AND ELSEWHERE.

A BRIGHT morning yesterday week, with a nip in the air, found many members of the Southern District Association of Gas Engineers and Managers, with the Hon. Secretary (Mr. H. C. Head), at Charing Cross Station, bent on a day's outing to the old Kentish town of Maidstone, where their President (Mr. Frank Livesey) carries on his professional and business activities. We were not long getting away from the bricks and mortar and grimy exteriors of all that constitutes the south-eastern part of the great Metropolis, and then into the wooded and highly cultivated "Garden of England"—the beauties of which gained the appreciation of those who had not before this had an opportunity to make much acquaintance with this part of the country, and more especially in early summer time. The journey was mainly spent discussing the current affairs and continued difficulties of the gas industry—difficulties which rise menacingly between its responsible men and the excellent prospects for development. But withal there was good spirit evident everywhere. So when Maidstone Station was reached, and the President was found on the platform, greetings were of the heartiest; and all set out to enjoy thoroughly the respite from the cares of everyday work.

VISIT TO THE GAS-WORKS.

The first item on the programme for the day was a visit to the gas-works. On arriving there, members were found who had travelled from parts which did not call upon them to make a journey from London. Members of the Company's Board of Directors were also present to receive the visitors; and some of them went through the day to its happy end. It was due very largely to the Board that the day was all that it was from the point of view of enjoyment; for they had entered into its arrangements with the same enthusiasm as the President himself. They are men one and all who realize, and, realizing, act up to the view, that they as Directors are part and parcel of a system of administration in which they and their chief executive officer must act as one. There were regrets. The Chairman—a good friend of gas men and of gas interests—Mr. George Marsham, and the Vice-Chairman (Dr. Hoar) were both away indisposed; and therefore their colleagues, Mr. Edward Hills, Mr. Frederick Laurence, Mr. W. H. Bensted, Mr. W. Day, and Mr. G. Foster Clark (who is also the worthy Mayor of Maidstone), and the Secretary (Mr. F. A. Gulland) felt doubly bound to exercise themselves to do the honours of the occasion. How well they succeeded is sufficiently shown by the fact that they were soon so much settled in as part of the company that the distinction between hosts and guests was altogether lost to mind.

However, we met near a picturesque old house by the entrance-gate to the works, which is now the manager's office, and has a history reputed to extend 600 years back in the ages. It was formerly a hostel—or rest-house—for travellers; and Mr. Livesey told us that an underground passage (which has only been filled-in in the last few years) runs from the building towards the Medway. We looked at its aged exterior; and the thought passed as to the tales it could tell if only it had vocal powers. The visitors were split up into parties; and under the guidance of Mr. Livesey, the Assistant (Mr. H. Small), and the Chemist and Draughtsman (Mr. F. Ware), the works were explored. What was seen will be gathered from the following brief descriptive notes.

The Maidstone Gas Company dates from 1823, when the Company was incorporated by Act of Parliament, and the first supply given. The works occupy a site of 9 acres on either side of St. Peter Street, with a frontage of 980 ft. to the River Medway.

There are two retort-houses. No. 1 house was built in 1878, and contained fourteen beds of sixes, served by West's manual machinery. It was in this retort-house that Mr. John West carried out his original experiments with coal crushing and elevating plant, and manual and power stoking machinery. The house has not been used since 1892, and is largely dismantled. The eastern end is now divided-off, and contains two Humphreys and Glasgow carburetted water-gas plants, each of 500,000 c.ft. per day output. No. 2 retort-house was built in 1892, and contains twelve beds of eight set in three tiers. The retorts are 22 in. by 16 in. section by 21 ft. long. Charging and discharging is done by a De Brouwer combined stoking-machine.

The cooling plant consists of a long length of foul main, a Colman cyclone, and a set of air-cooled annular condensers.

The coke is removed from the retort-house by two De Brouwer conveyors; the total storage of unscreened coke being 900 tons. In the generating house are two 35 KW. dynamos, direct coupled to 50-H.P. gas-engines, running at 230 revolutions. Adjoining this building are the fitting and blacksmiths' shops. The coal-stores have a capacity just under 5000 tons; but additional storage has been provided in the open to meet war conditions. At one end of the coal-stores, coal is delivered from barges by steam crane and grab; and, at the other end of the store, it is elevated from railway trucks. An underground Zimmer conveyor removes the coal from the stores to the retort-house.

In the engine-room are three Bryan Donkin exhausters—one of 100,000 c.ft. per hour, and two of 50,000 c.ft. per hour capacity. The engine-room also contains a gas-compressor for Botley's carburation process, and the necessary pumps for the water-gas plant. Blast is supplied to the carburetted water-gas plants by two fans, gear-driven off 15 H.P. De Laval turbines. The two Lancashire boilers, 21 ft. long by 7 ft. in diameter, are fitted with Meldrum's forced draught.

As to the washing and scrubbing plant, there are two Livesey washers and two Kirkham-Hulett scrubbers, the liquor circulating through all these in succession by gravity. The meter and governor

house contains two Cowan station meters of 40,000 c.ft. per hour capacity. Three governors have distinct duties—one serves the district east of the Medway, one the district west of the Medway, and one is a reserve for assisting either of the other two at times of greatest load. A safety bye-pass governor is fitted to operate in case of a mistake being made in valve-changing.

The Company possess three gasholders: No. 3, 150 ft. diameter, and with a capacity of 1,196,900 c.ft.; No. 2, 100 ft. diameter, and a capacity of 438,450 c.ft.; and No. 1, 80 ft. diameter, capacity 230,000 c.ft. No. 1, which is used as a relief holder for the water-gas plant, was erected in 1859, and so has done good service. The gas is treated by the Botley carburation process on the inlet of the governors. Two gas-compressors are in use. They are by Waller, are of 30,000 c.ft. per hour capacity, at 3 lbs. pressure, and are gear-driven from 25-H.P. gas-engines.

For purification the gas is split into two streams, each stream passing through four boxes, 24 ft. square by 5 ft. 6 in. deep, controlled by water-valves. A third set of purifiers, dating from 1868, can still be used as a catch; but this set is due to be demolished.

All the tar made is treated by a Wilton's dehydration plant, and near to this is the debenzolizing plant—at present out of action.

Luncheon and Some Speeches.

A good hour was spent on the works; and then there was a walk through the town to the Star Hotel, passing on the way the Company's show-rooms, which occupy perhaps the most prominent site in the shopping centre. There is large window space here; and the windows are constantly having their exhibits varied. Just now in one of them is a water-circulating boiler in action, and supplying the whole building with hot water—all particulars as to the working being available to the visitor, and effectiveness can be judged by him or her at any point where provision is made for the drawing-off of hot water.

A few steps further on is the Star Hotel, where, at the two long tables, the visitors were soon seated, with, at the top cross table, the Directors (Mr. Edward Hills in the chair), the President of the Association, and the President of the Institution of Gas Engineers (Mr. Samuel Glover). The lunch was thoroughly enjoyed; and the members could not depart without wishing their hosts and the town all the prosperity that they both richly deserve. The loyal toast was honoured; and then

Mr. Glover proposed "Prosperity to the Maidstone Gas Company." He referred to the great pleasure that it had given his professional colleagues to accept the cordial invitation of the Chairman and Directors; and expressed the deep regret which they all felt at the absence, through ill-health, of both Mr. Marsham and Dr. Hoar. He thanked them, too, in the names of those present, for the technical interest afforded by the visit to the works, and not less for their generous hospitality at the lunch, as well as for the pleasure in store of a trip on the Medway. He asked the Directors who were present to convey to the Chairman and Deputy-Chairman the feeling of appreciation of their visitors for all that had been done for their comfort, interest, and enjoyment.

Mr. Hills, in the name of the Chairman, Deputy-Chairman, and the other members of the Board, thanked the visitors for their cordial and enthusiastic reception of the toast proposed in such kind terms by Mr. Glover. The Directors were very pleased to see them there; but he asked them not to measure the warmth of their welcome by the scope of their entertainment. This was a pleasant occasion for the Directors. Very often there was a fly in the ointment; and on this occasion, it was the unfortunate illness of their Chairman and Deputy-Chairman. Mr. Marsham was such an ideal Chairman. He had a fine charm of manner; and at all times he created an atmosphere of geniality and friendship around him. They missed him greatly on this occasion; and they were also sorry that Dr. Hoar could not be present. He alluded to the large area covered by the Association; and he congratulated the Company's popular Manager on the high position he had attained in being elected its President. Men occupying such important offices as those present the Directors were glad to receive not only as an Association, but as individuals. In his opinion, it was well that engineers and directors should meet together in friendly intercourse, because he believed that it fostered mutual respect and appreciation. The technical men were the eyes and the ears of the industry; and the duty of the directors was to apply the fruits of their labour to the best advantage they could for consumers and shareholders. The members were there to do honour to Mr. Livesey, for whom personally, and for whose capabilities, the Directors had a great regard. Mr. Livesey was not one who was content to rest upon what he (Mr. Hills) might call the adventitious reputation of a great name; but by application, by perseverance, by industry, by the cultivation of his hereditary powers and great gifts, he intended to earn for himself the right to bear the name. [Applause.] Before sitting down, he should like to say they had passed through troublesome and very difficult times during the last four or five years; and they were not yet out of the wood. He was not a confirmed optimist; but he was bound to say that lately he had come to feel there was a great future for their industry. The formation of the National Gas Council was a splendid idea; he looked for great things from it. Just recently, too, they had had something very encouraging in the report of the Board of Fuel Research, and in the case of the gas industry on coal conservation that had been prepared by Sir Dugald Clerk and Prof. Smithells and Prof. Cobb. These were both very inspiring to the industry; and the industry had established the fact that it could hold its own in lighting and power, and so far as heating was concerned, it could win hands-down. He felt that, though gas undertakings had been passing through the valley of affliction, and were still to a certain extent in the valley, there was a great future for them, and that they would soon again be on the broad road of prosperity. [Applause.]

Mr. J. R. H. Jacobs submitted the toast of "Prosperity to the Town and Trade of Maidstone," and response was made by the Mayor. Then the Chairman proposed the "Health of the President," which supplied the members with an opportunity of giving him quite an ovation on rising to respond.

On the Medway and at Allington Castle.

The company left the Star Hotel feeling at peace with all men. Walking down to near Maidstone Bridge, a lighter and tug were found, the former being decked in a double sense in manner for which in her career there was no precedent. A temporary deck had been erected on it. This was carpeted, and small deck chairs and tables were plentifully scattered over it. Round the sides hung flags. The party boarded the vessel whose natural form and identity had been so hidden, and were soon being drawn down the Medway—as great objects of interest to those on the banks as the ever-changing and beautiful landscape was to those on board. The octogenarian Mr. Bensted, youthfully buoyant as ever, who is deeply versed in the topography of the district, pointed out and described the numerous features on the banks of the river as they were passed. A nice comfortable trip, with a jolt or two against vagrant and unpolite barges, brought the party to Allington Castle, which Sir Martin Conway, who came into possession of it some fourteen years or so ago, very kindly threw open to the inspection of the visitors. Standing amid the ruins, one could appreciate the glories of the place in ages long since dead. In other directions were noted the work of restoration upon which Sir Martin was engaged before the war; and inside was seen the considerable progress that has been made in converting ancient work to modern ideas of comfort and refinement. The interest of the place kept the visitors there somewhat beyond the allotted time; and they left feeling much gratification to Sir Martin for his courtesy in permitting the inspection of this stately memorial to times long since dead.

Then the party again boarded the decked lighter; and she proceeded on her way by the aid of the tug. More picturesque country; and then the huge cement works, which once purchased much of our coke, but have gone in for new systems of firing, for which the gas industry is not particularly thankful, though gratified that its loss is the gain of another industry. So progress was made, the Medway broadened, and more life was seen on its waters, which spoke of the thriving industries on her banks. Near about 6.15 Strood Pier was reached; and then farewells were taken of the President of the Association and the Directors of the Maidstone Gas Company, and the journeys home commenced, filled with recollections of a most delightful day.

SIXTY YEARS AGO.

[From the "Journal" for May, 1859.]

Make of Gas per Ton.—At the last meeting of the Great Central Gas Consumers' Company, it was announced that the Arbitrators had awarded to the Company £2724 for dilapidations to the works during Messrs. Priors' tenancy of about eighteen months' duration. This is apparently a large sum; but we understand a portion of it arises under a clause in Messrs. Priors' contract, by which they bound themselves to deliver up the works in such a state of repair as would enable the Company to produce 9500 c.ft. of gas from every ton of coal carbonized, and that the Arbitrators took into consideration the loss which the Company must sustain through the breach of this covenant.

Rival Gas Companies at Cork.—It will be seen from the report of the Cork meeting that Mr. Anderson and Mr. Maguire feel aggrieved by the notice we have taken of their proceedings in connection with the Cork Consumers' Company. With respect to the former, we only gave publicity to his acts, which most men would think complimentary rather than otherwise. He blew hot in one place, and he blew cold in another; and we mentioned the facts as they appeared. In Waterford he stated that 6s. per 1000 c.ft. was a reasonable price for 10-candle gas when supplied by his own Company, whereas at Cork he reported such a price to be exorbitant, and that 4s. 6d. per 1000 c.ft. for gas of better quality would be abundantly remunerative. We published the substance of his reports; and gave him the opportunity of reconciling their discrepancy. He has not accepted the opportunity, but returns the proffered favour with abuse. Mr. Maguire is equally unreasonable and ungrateful. When Mr. Anderson complained at the meeting that we had traduced the Cork Company most abominably, and called them everything but gentlemen, Mr. Maguire interrupted him to add, "Oh! worse." We must remind the honourable gentleman that it was not until he compared himself to a pig that we gave him a gentle roasting; and we did it so much to his own satisfaction that he beseeched us to give him another turn. He afterwards fancied himself an oyster, when we hinted that the shareholders would only get the shells; and we ventured to predict that in the exuberance of his imagination he might even fancy himself a goose, and imagine we had cooked it. All these similitudes were suggested by the honourable member himself, who cannot therefore reasonably complain if we called him otherwise than a gentleman.

Temporary Increase of Charges Act.—The Local Government Board have made an Order in favour of the Borough of Abergavenny, under the Statutory Undertakings (Temporary Increase of Charges) Act, raising the maximum price from 5s. to 5s. 10d. per 1000 c.ft.

THE TOWN'S GAS OF THE FUTURE.

The Presence and Effect of Inerts.

JUST two years ago, Dr. Lessing was instructed by the Directors of the South Suburban Gas Company to prepare a report on the subject of the quality of town gas to be supplied in future, and in particular on the question of the presence and effect of non-combustible gases. He was asked, not only to discuss the problem from the Company's point of view of manufacture and supply, but to investigate particularly the directions in which the consumer is likely to be affected by different qualities of gas supplied to him.

In view of the recent issue of the report of the Fuel Research Board [*ante*, p. 238], in which the subject of inert gases is dealt with, the Chairman of the South Suburban Gas Company (Mr. Charles Hunt, M.Inst.C.E.) has now permitted the results of Dr. Lessing's investigations, as embodied in his report, to be published; and Dr. Lessing himself has—at our request—kindly prepared the following notes of the principal portions of his somewhat lengthy report. Readers in perusing what he says should bear in mind the fact that the report is dated May 29, 1917, when many of the questions at present agitating the gas profession had not been discussed, and the problem of steaming retorts and the acute fuel shortage had not arisen.

Dr. Lessing said it might be taken for granted that the value of coal gas as a commodity depends in the first instance on its chemical composition. The expression of the aggregate of its constituents and their properties by a composite physical value such as its heating or illuminating power may be convenient and even necessary for the business relations of gas undertakings with their consumers; but the mere fact that gases of widely differing chemical composition, and consequently commercial value, may have the same calorific value shows the importance of due consideration from the analytical point of view.

In discussing the inert gases, Dr. Lessing examined in great detail the sources from which carbon dioxide and nitrogen are derived—the former produced as a primary product mainly during the early stages of carbonization. Some of it is pulled into the retort in the form of furnace gases (if pressure conditions permit) through pores and cracks. Most of the carbon dioxide is reduced to carbon monoxide as soon as the charge has assumed a sufficiently high temperature. In water-gas making the presence of carbon dioxide is unavoidable—its amount depending on the temperature and depth of the fuel-bed.

The amount of nitrogen that is derived from the coal may vary, with a make of 12,500 c.ft. per ton, from 0·6 to 1·1 p.ct. in the gas. The bulk of the nitrogen is pulled into the retorts along with the carbon dioxide, and represents the residue of the fire gases; the free oxygen and the CO_2 having been converted into carbon monoxide.

A certain amount of air is pulled in through the mouthpiece joints during carbonization, and would be deprived of its oxygen by the current of hot gases and tarry matter meeting it in the ascension pipe. Some air enters the system during charging operations; some is sucked into the gas stream through leaks which are bound to occur between the ascension pipe and the exhauster; and some is admitted by suction for the purpose of revivifying oxide *in situ*. Oxygen appearing in the gas after the purifiers indicates an excess of air from this source; and each percentage of the oxygen is responsible for a further 4 p.ct. of nitrogen. The air dissolved in the scrubbing water is negligible; and the residual nitrogen derived from the steam in water-gas making does not exceed 0·03 p.ct.

The report then discusses the effect of the non-combustible gases on the calorific and illuminating value, flame temperature, heating efficiency, and distribution of the gases. After showing by means of a table the variation of calorific value as being directly proportional to the percentage of combustible matter, Dr. Lessing proceeds to point out that the relation of the composition of the gas to the calorific value is of the utmost importance not only as regards the percentage of non-combustible, but also the kind and distribution of the combustible constituents.

Table I. shows the composition of an average gas actually supplied, including the minor constituents. Taking account of these, excellent agreement was obtained between the calculated (518 B.Th.U.) and the ascertained calorific value (523 B.Th.U.). As far as the actual testing for calorific value is concerned, the presence of non-combustible matter should have practically no influence, provided the "total heat" is observed or calculated. The reason for this is that, in calorimetric work, the products of combustion are (or should be) cooled to practically the temperature at which the gas and air enter the instrument. All sensible heat is, therefore, abstracted from the products of combustion as well as from the inert gases and the excess air.

In practice, however, the position is very different. There is hardly a domestic or industrial application of town's gas in which such a complete heat recovery as in a calorimeter could really be effected; and in practically every case the products of combustion leave the flue or other appliance carrying a considerable percentage of the calorific energy produced, in the form of sensible heat. The amount of heat thus lost is a function of the temperature and the specific heat of the products of combustion; and this loss is obviously added to if their bulk is increased by non-combustible gases.

As it may be justly argued that the combustible portion of the total mixture of gas and air is a comparatively small one, Dr. Lessing proceeds to discuss this relation in some detail.

If the oxygen present in the gas is neglected, the air required by theory for complete combustion is 464·6 c.ft. per 100 c.ft. of the same gas. In practice, an excess over the theoretical amount is necessary; and for the purpose of the following considerations a 40 p.ct. excess over theory has been assumed. On this basis, 651·3 c.ft. of air are required per 100 c.ft. of gas, or approximately a ratio of air to gas of 6·5 : 1.

In order to study the effect of varying percentages of inert gases, a series of mixtures of the combustible portion of the gas of ascertained composition were assumed with inert percentages up to 50 p.ct.; the excessive amount being chosen in order to observe the tendency in an exaggerated form.

The air requirements for these various gases were calculated; and the percentages of combustible, inert, and total gas in the gas-air were ascertained. Graph A shows the figures for mixtures made with theoretical air requirements; Graph B, the corresponding figures with a 40 p.ct. excess.

It will be noticed that the percentage of combustible gas in the mixture varies to a surprisingly small degree; the curve being an almost straight horizontal line. This observation is quite in accordance with actual experience. For instance, in gas-engine work, where the air requirements for each gas are of necessity

TABLE I.—*Showing Detailed Composition, Calorific Value, and Oxygen Requirements of Mixed Gas.*

	Per Cent.		B.Th.U. per C.Ft. of Constituent at 60° and 30 in. moist.	B.Th.U. per C.Ft. of total Gas at 60° and 30 in. moist.		Oxygen required for Combustion of		Air required (Theory).
						1 Vol. Component.	100 Vols. Gas.	
SAT. HYDROCAR. GASES.								
Methane	22·68		992	224·96		2·0	45·36	
Ethane	1·53		1730	26·47		3·5	5·36	
Propane	·31		2007	6·20		5·0	1·55	
		24·52			257·63			
UNSAT. HYDRO. GASES.								
Ethylene	2·89		1559	45·06		3·0	8·67	
Propylene	·29		2301	6·67		4·5	1·31	
Butylene	·05		3042	1·52		6·0	·30	
Acetylene	·10		1452	1·45		2·5	·25	
		3·33			54·70			
VAPOURS.								
Benzene	·72		3738	26·91		7·5	5·30	
Toluene	·13		4378	5·69		9·0	1·17	
Xylene, &c.	·22		5099	11·22		13·0	2·86	
Naphthalene	·01		5783	·58		12·0	·12	
Carbon bisulphide	·03		1240	·37		3·0	·09	
		1·11			44·77			
OTHER GASES.								
Carbon monoxide	12·69		318	40·35		0·5	6·35	
Hydrogen	37·73		320	120·74		0·5	18·87	
		50·42			161·09			
INERT GASES.								
Carbon Dioxide	4·07		..	..			..	
Oxygen	1·09		..	..			..	
Nitrogen	15·46		..	..			..	
		20·62						
		100·00		518·19	518·19		97·56	464·6

carefully adjusted, and where gases varying from 1000 to 300 B.Th.U. per c.ft. give almost identical mixture strength.

While it appears that the amount of inert gases in the gas-air mixture is negligible, and certainly extremely small even with the uncommonly high percentages shown in the charts, and particularly so where a reasonable excess of air (Graph B) over that theoretically required (Graph A) is used, the report points out the fact that in most ordinary appliances the admixture of air cannot be as finely adjusted or that its adjustment is altogether impracticable. The tendency is, therefore, for an undue excess of air to be used for combustion when the percentage of non-combustible in the gas is increased.

If, for instance, it is assumed that a fixed amount of air will be added to the gas whatever is its content of non-combustibles, the values shown in Graph C are obtained. In this case the air (*plus* 40 p.ct. excess) required for the gas free from inert matter is taken as a standard; and it will be seen that the influence of inert gases is very marked.

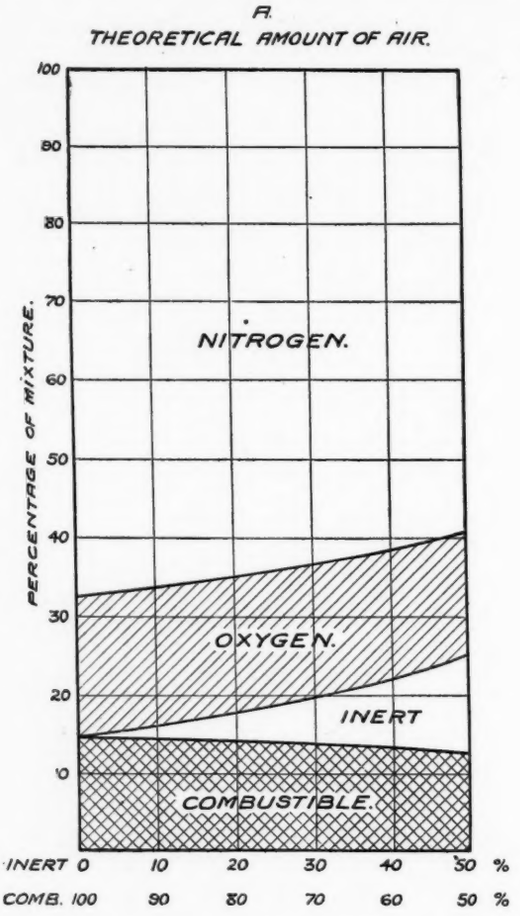
The assumption made for the calculation of Graph C, although demonstrating the tendency, is not strictly correct; for in atmospheric burners constructed on the bunsen principle the amount of air aspirated is not the same with all gases, but follows a definite mathematical law which depends upon the specific gravity of the gas used. All other conditions being equal—viz., the orifice

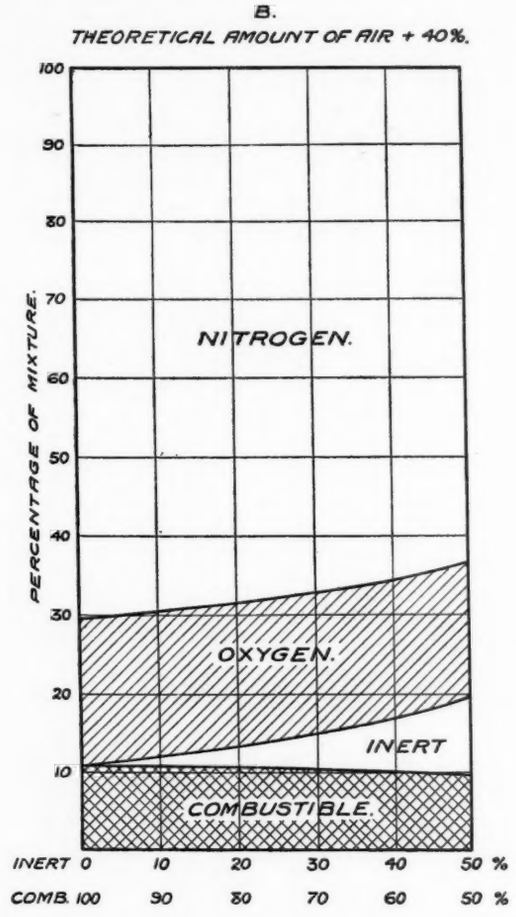
Table II.—*Showing the Composition of the Gas-Air Mixture as Regards Combustible, Inert Gas, and Added Air.*

Air as Aspirated (Based on Theory *plus* 40 p.ct. Excess).

In Gas.			For 100 Parts Gas.		In Gas-Air Mixture.		
Combustible.	Inert.	Total Gas.	Air Aspirated.	Gas-Air Mixture.	Combustible.	Inert.	Total Gas.
Per Cent.	Per Cent.	Per Cent.			Per Cent	Per Cent.	Per Cent.
100	..	100	824·3	924·3	10·82	..	10·82
95	5	100	800·6	900·6	10·55	0·55	11·10
90	10	100	780·4	880·4	10·22	1·14	11·36
85	15	100	760·2	860·2	9·88	1·75	11·63
80	20	100	742·9	842·9	9·49	2·37	11·86
75	25	100	725·4	825·4	9·01	3·11	12·12
70	30	100	710·3	810·3	8·64	3·70	12·34
65	35	100	695·0	795·0	8·18	4·40	12·58
60	40	100	681·7	781·7	7·68	5·11	12·79
55	45	100	668·1	768·1	7·16	5·86	13·02
50	50	100	656·2	756·2	6·61	6·61	13·22

will be affected by the presence of inert gases, but probably not to a greater degree than by the abstraction of the heavy hydrocarbons (benzol) of great oxygen avidity.





of the gas injector tube, the length and diameter of the burner tube, the size and distribution of the air-ports, the pressure and velocity of the gas, the ratio of the volume of air aspirated by injector action, to the unit volume of gas may be expressed by:

$$q = k \sqrt{\frac{d}{d^1}}$$

where d is the density of air, d^1 the density of the gas, and k the constant comprising all other conditions. This formula permits us to calculate the amount of air aspirated by gases of varying specific gravity, and the composition of the gas-air mixtures formed (other conditions remaining unaltered). If, for the sake of simplicity, no account is taken of CO_2, and if it is now assumed that the standard gas (100 p.ct. combustible) is diluted with varying amounts of nitrogen, values are obtained from which Table II. was calculated and Graph D constructed.

After stating that the loss in heating efficiency caused by the increase of non-combustible gases will obviously never be as acute in practice as is shown towards the extreme end of the charts, and having dealt with the heat balance—*i.e.*, the useful recovery and the loss of heat as affected by inert constituents—Dr. Lessing proceeds to discuss their influence on flame temperature and heat intensity. He states that the form of flame

It is manifest from the tables and charts that the presence of the inert gases, and the consequent increase in the volume of the gas-air mixture must influence the size of flame in direct proportion to the increment in volume of mixture. This may be advantageous where long and cool flames are required, but will have a detrimental effect as regards the maximum temperature that is obtainable.

The question of flame temperature is probably the most important one in the consideration of non-combustible gases. It is a subject which, on account of the difficulty of its experimental treatment, has not received that close and general attention of investigators and practical engineers which its importance to the consumer of gaseous fuels would justify. Up to the present day we are largely restricted to calculated temperatures which are, in most cases, far in excess of those actually obtaining in the flames. For instance, values above 2000° C. (3632° Fahr.), which are sometimes given for flame temperature or "calorific intensity" of a bunsen burner, have never been obtained in practice.

After discussing the known methods of determining flame temperatures and stating that in experimental work on the water-gas equilibrium: $k = \frac{(H_2O) \times (CO)}{(CO_2) \times (H_2)}$ the only diluent employed was CO_2, the report lays stress on the desirability of reliable tests on

the influence of nitrogen and the most important constituents of coal gas on flame temperature by actual observation.

As far as our present knowledge goes, it is certain that non-combustible gases lower the flame temperature considerably. This is due, in the first instance, to direct cooling in proportion to the loss of specific heat of the added and inert gases; secondly, there is a decided lowering of the reaction velocity for which we have not yet a satisfactory scientific explanation. It may be that it is due to the reduced chance of collision between gas molecules, or else to an influence on the electric charge of the latter. There is even some experimental evidence which points to a catalytic action of hydrocarbons.

The importance of being able to obtain a maximum flame temperature cannot be over-estimated from the point of view of the further development of the gas industry; for it is easy for the gas consumer to reduce the flame temperature by dilution, but it is impossible for him to raise it for special purposes except by carburation or the application of oxygen in place of air.

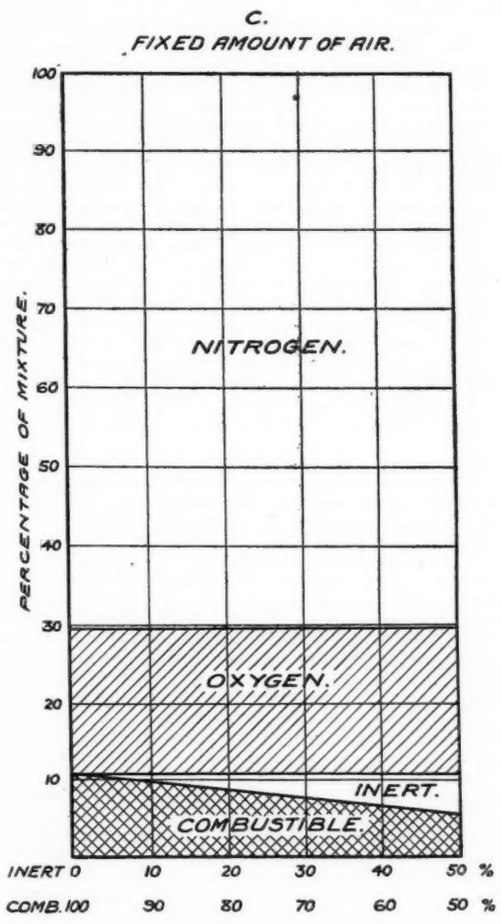
The effect of heating efficiency and flame temperature in practical working is discussed in the following four principal groups:

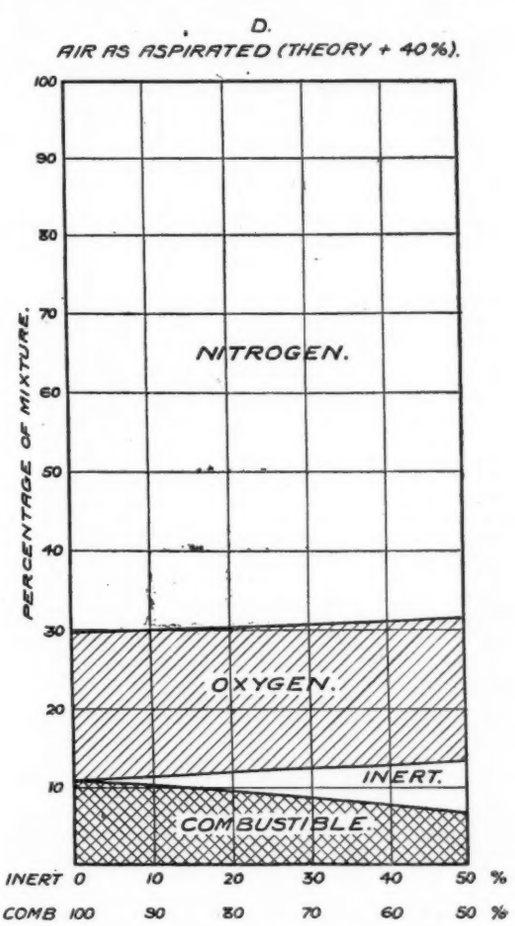
(1) *Low-Temperature Heating.*—In the case of water heaters, domestic cookers, bakers' ovens, industrial drying, &c., high flame-temperatures are not necessary—in fact, are undesirable. What is wanted is a high coefficient of transference of the heat at a temperature not too far above the temperature required or permissible for the work in question. The efficiency of application depends here largely on the more or less complete utilization of all the heat units contained in gas. The construction of the appliance has, in this case, greater influence upon the result than the composition of the gas. An undue excess of non-combustible gases will, however, tend to carry away sensible heat, with the products unused—to the detriment of the heating efficiency.

(2) *Ordinary High-Temperature Work.*—This class comprises incandescent mantles, domestic gas-fires, industrial heating. In most of these cases both heating efficiency and flame temperature are of vital importance. The work of the incandescent mantle is particularly dependent on obtaining a high flame-temperature. Since the emission of light from a mantle is proportional to a high power of the absolute temperature, a small increase of temperature has great effect on luminosity. The flame temperature, on the other hand, depends primarily on the fact that the smaller the external surface we can give to a flame consuming gas at a fixed rate, the higher must be the average temperature. Similar considerations apply to the domestic gas-fire, the efficiency of which depends largely on radiation. Here, as well as in most kinds of industrial heating, the efficiency of heat recovery is equally important.

(3) *Special High-Temperature Work.*—Under this heading come those operations by which large masses of material are to be heated to, and kept at, very high temperatures—*e.g.*, gas-muffles, the melting and annealing of metals, ceramic work, autogenous welding and cutting. In all these cases the object is to raise large masses of refractory materials or metals to incandescence or to their melting points, and keep them at such high temperatures at a minimum expenditure of thermal units. It is obvious that for high intensive work as concentrated a mixture of combustible gas and air as possible should be used, the dilution of mixtures with non-combustible gases is prohibitive. Indeed, for the welding and cutting of steel, it is necessary to employ neat oxygen in place of air, in order to obtain greater concentration and localization of heat, and consequently a higher temperature.

(4) *Gas-Engines.*—Gas-engine efficiency does not depend on high calorific value or freedom from non-combustible gases. This is due to the fact that the air supply must of necessity be most carefully adjusted, and that explosion will be propagated under compression in mixtures containing a rather smaller percentage of combustibles than would suffice for combustion in open flames. Hence, gas-engines can be worked efficiently with gases of a wide range of calorific value and chemical composition—from natural gas of 1000 B.Th.U. down to producer gas of 150 B.Th.U. It should be stated that all these considerations apply to gases of otherwise unaltered composition, which have been merely mixed with varying amounts of non-combustible matter. The effect of the composition of combustible gas is of itself a subject of vast importance, which will be dealt with later.





Alluding to the effect of inert gases on distribution, Dr. Lessing states that the specific gravity of pure coal gas rises considerably with the addition of nitrogen. Obviously an addition of carbon dioxide with a density of 1·52 to 1·53 (air = 1) will raise the average density of the gas at a still higher rate.

The increased power required for distributing a heavier gas may be a negligible factor; but it is interesting to inquire into the total cost of distribution of non-combustible gas, taking into consideration the extra capacity of mains, power, supervision, and general cost of distribution. It is fair to assume—particularly with large undertakings—that the cost of distribution is proportional to the quantity of gas distributed. It is admitted that, with small undertakings with only a minimum distributing staff, this assumption would not be correct. Taking the cost of distribution at the average figure of 6d. per 1000 c.ft., the total for (say) 200,000 million c.ft. of gas made in the United Kingdom would be £5,000,000; and if an average of 15 p.ct. of inert gases be taken, the proportional cost for the distribution of this dead-weight works out at £750,000 per annum. This figure, immense

as it appears, is probably on the low side, if capital charges on mains and service pipes and other items are duly taken into account; and the percentage of inert gases is certainly a low one for present conditions.

The cost of distribution varies largely according to the conditions in which different undertakings are placed; but it is fair to conclude that each undertaking (however favourable its conditions of distribution) will have to bear a share of this very heavy burden.

Some engineers are apt to forget that the intentional or negligent admixture of excessive percentages of inert gases may be effected at little, or almost no, expenditure on the manufacturing side. But their distribution involves a cost which is equal to, or rather higher than, that of combustible gas, and which is in most cases a large portion of the total cost.

It has been shown that the larger portion of the nitrogen is due to "over-pulling." The only advantage from this procedure, which is of a purely financial kind, is that air or residual nitrogen from the air is sold at the rate of coal gas. This is, however, not strictly correct; for the action of drawing furnace gases into the retort indirectly produces conditions which lead to considerable expenditure. The action of oxygen, which is always present in furnace gases, causes local superheating of the coal or primary products of carbonization. It so happens that all the troubles feared by the gas engineer—scurf, stopped ascension pipes, naphthalene, or organic sulphur compounds—are high-temperature products. Although the point is very difficult to prove experimentally, there is no doubt whatever that the incidence of these products is due to a kind of local combustion, probably influenced by catalysis, at temperatures which are momentarily far above the average temperature of the charge inside the retort. If, therefore, the extra expense, labour, and general disadvantage connected with the formation of the above-named products is expressed in money value, and the cost of distribution of the inert gas is taken into account, it will be found that the nitrogen is by no means obtained free of charge. Even amounts of non-combustible gases which are to-day considered to be reasonable, should be diminished in the interests of the further development of the gas industry. For this purpose the present methods of keeping a level gauge are hardly sufficient, and some much more accurate adjustment is required. The avoidance of pressure or suction inside the retort is not enough. As the retort forms a permeable septum of considerable porosity, it is necessary that the pressure or suction obtaining in the setting outside is duly accounted for. The installation of differential gauges connecting the inside of the retort with the setting is recommended. It must be further borne in mind that the pressure differences in the setting vary considerably, according to the height, zone, travel, and temperature of the gases of combustion.

Since the introduction of the revivification of oxide purifying material *in situ* the addition of air to the gas-stream has become quite legitimate and even necessary. It is, however, a fact that very frequently the amount of air thus introduced is not adjusted with the accuracy one might expect, and consequently rather more air is introduced than is necessary for the work. An excess may sometimes lead to spontaneous heating of spent oxide.

The fixation of ammonia and the oxidation of iron or cyanogen compounds (where the latter are extracted) make it preferable to admit the air after the scrubbers, and immediately before the purifiers, by an auxiliary blower the output of which could be adjusted to the make of gas at any given moment.

If the future policy should dictate the reduction of inert gases to a minimum, it would be even possible to dispense with the practice of admitting air to the purifiers and to effect the revivification by blowing the flue gases containing an excess of oxygen through each box in rotation, and outside the gas stream.

The amount and possible reduction of carbon dioxide in water-gas making depends, in the first instance, on the system chosen, and particularly on the depth of the coke layer. If necessary, it can be reduced to a minimum, but never avoided. The presence of nitrogen is mainly due to imperfect scavenging at the beginning of the run, when the generator is still filled with the products of combustion. Its reduction to a minimum would involve a decrease in the make of gas, and might not offer corresponding advantages.

As to the types of gas to be made, there cannot be any doubt that the days of "rich" gas are gone, and that the tendency is a right one to supply gaseous fuel of a kind which allows it to compete with solid and liquid fuels, not only by reason of greater convenience and efficiency but also on a more equitable basis of price. This tendency necessitates the maximum yield of gaseous products obtainable from coal under conditions which incidentally produce the maximum value of bye-products.

By reason of an increased make of gas per ton of coal, its quality must of necessity be modified. In comparison with the "rich" gas made (say) from twenty to thirty years ago, the "high make" gas is bound to be a "leaner" gas, although not necessarily a gas of poorer or less useful quality. There are a number of ways in which the yield of gaseous products per ton of coal can be increased over that formerly and even at present largely obtained.

The most obvious method of increasing the yield of gaseous products from coal is the addition of a certain percentage of water gas. Water gas was introduced into gas-works practice in the first instance with the ostensible object of providing a ready means for the increase of illuminating power. This was owing to its capacity of accompanying gas oil on its path through a high-temperature cracking process, without its sustaining any damage; while coal gas, if it were treated under similar conditions, would suffer considerably from the thermal decomposition of its hydrocarbon constituents. An incidental advantage of water gas was the possibility of gasifying completely a certain proportion of the coke made in the carbonizing process.

Blue water gas (as distinct from the carburetted variety) was also used, but mostly in conjunction with carburation by benzol or highly volatile petroleum distillates.

With the decline in importance of illuminating value, the function of water gas as an enriching agent or adjunct has largely lost its significance, except in those cases where an undue amount of inert gases is added which have to be brought up to standard by such an expedient.

To this change in conditions must be added the steady rise in the price of gas oil (which, in view of the expansion of liquid fuel requirements, is likely to continue after the war), and also our dependence on foreign countries for the supply of such oils. Instead of being a user of imported liquid fuel, the gas industry will have to become a producer of liquid products from coal on a very much larger scale than hitherto. The yield of gas per ton of coal will, therefore, have to be augmented by blue water gas in cases where the yield of straight coal gas is not considered sufficient, and at times when coke does not find a ready or better paying market.

The reduction in illuminating power depends largely on the percentage and kinds of illuminants in the coal gas, while the lowering of the calorific value is merely proportional to that of the two gases to be mixed, and can be arrived at arithmetically. The simplest way of adding blue water gas to coal gas is to add the finished gases before or else at the holder. However, it is suggested that the introduction of blue water gas into the coal-gas retorts is a subject which deserves renewed investigation.

The South Suburban Gas Company took the lead in giving a trial to the late Prof. Lewes's process of autocarburation. At that time the problem was largely one of raising the illuminating power, as was done in the carburetted water gas plant. The main reasons for which Dr. Lessing recommends experiments in this direction are quite different in principle. He expects from such a procedure a beneficial influence of the water gas on the carbonizing process, whereby it would act as a protective agent for the primary products of the decomposition of the coal.

As to the limit of its admixture with straight coal gas, Dr. Lessing believes a mixture containing up to 30 p.ct. of blue water gas will satisfy most requirements, but would hesitate to recommend the raising of this limit to (say) 50 p.ct. without further close investigation.

The disposal of a large proportion of the coke produced in the retort-house is, of course, a great inducement; but in times of a greater demand for coke it will not be so easy to alter the quality of the gas without affecting the appliances in the district. The lowering of the calorific value to somewhere near 400 B.Th.U. may not be a direct disadvantage, although a gas of higher calorific intensity might be preferable. A higher percentage of carbon monoxide need not be taken too seriously, as it merely involves a question of improved fitter's work. The principal disadvantage of a high percentage of blue water gas seems to be the probable production of iron carbonyl by the action of such a gas rich in carbon monoxide upon the iron mains and service pipes. This contingency will set a limit to the indefinite increase of the water gas proportion more than any other factor.

The increase in the make of coal gas which has been obtained largely by pushing carbonization temperatures to a much higher degree than (say) ten years ago has led many engineers to adopt the view that such temperatures are necessary in order to release all the volatile products from, or get all the gas out of, the coal. This view is erroneous. Coal can be decomposed and deprived of practically all volatile products of decomposition at moderate or comparatively low temperatures. The increase in volume of gas—where it is not obtained by mere over-pulling—is rather due to the secondary action of the heat upon the primary products of decomposition immediately after they are liberated from the coal substance. As is well known, the volume of the gas evolved can be increased very considerably by such thermal decomposition of the primary products.

Briefly, this decomposition amounts to a cracking-up of heavier hydrocarbon molecules into smaller and lighter fractions; and it can be driven to an extent where all the carbon contained in the gas is deposited in solid form, and the hydrogen (together with the original contents of carbon monoxide and nitrogen) remains. [See Dr. Lessing's patent No. 15,071 of 1909.] As all the hydrocarbons other than acetylene contain more than two atoms of hydrogen, it follows from the molecular theory that by the liberation of hydrogen or fragments richer in hydrogen than the original molecules, the volume will be increased. The maximum volume of such a gas which would be of a calorific value similar to blue-water gas, and would contain up to 90 p.ct. of hydrogen, can be calculated from Table III., and gives an increase of one-third over the original gas.

While a completely cracked gas would be of little use for ordinary purposes, a gas whose decomposition has not been driven to such extremes may be quite useful. In Mr. Charles Hunt's experiments detailed in Vol. 117 of the "Proceedings of the Institution of Civil Engineers" (1894) in which he obtained a yield of 14,149 c.ft. of gas from a North Staffordshire coal in an iron retort which

TABLE III.—*Showing the Increase in Volume of Constituents Containing Hydrogen upon Complete Thermal Degradation.*

—	In Gas.	Vols. Hydrogen per Vol. Constituent.	Total Hydrogen.
	Per Cent.		Per Cent.
SATURATED HYDROCARBON GASES—			
Methane	22·68	2	45·36
Ethane	1·53	3	4·59
Propane	·31	4	1·24
			51·19
UNSATURATED HYDROCARBON GASES—			
Ethylene	2·89	2	5·78
Propylene	·29	3	·87
Butylene	·05	4	·20
Acetylene	·10	1	·10
			6·95
VAPOURS—			
Benzene	·72	3	2·16
Toluene	·13	4	·52
Xylene	·22	5	1·10
Naphthalene	·01	4	·04
			3·82
Hydrogen	37·73		37·73
Other gases	33·34		33·34
	100·00		133·03

precluded pulling in air or fire gases, the multiple "candles per ton" is almost the same as that obtained at a lower temperature which yielded only 11,179 c.ft.—showing that the volume increase was due to degradation of the gas, accompanied by a deposition of carbon whereby the carbon-to-hydrogen ratio was lowered.

This carbon which may take the form of retort carbon (scurf), lamp black, stoppages in ascension pipes, or free carbon in tar, is in all cases the product of such a secondary decomposition, and forms an immense reserve of gas-making material, if methods of carbonization are devised by which its union with hydrogen is protected and its liberation in solid form is prevented. A condition for success in this direction is that the temperature of carbonization should not be driven to extremes, or should even be lowered from that at present considered normal. It may even be necessary to separate the operation of destructively distilling coal from the fixation of the primary products into permanent gas at the optimum temperature.

For, while coal can be carbonized completely at very low temperatures, it cannot be gainsaid that the application of a high temperature, and the consequent steep heating gradient, facilitates rapidity in carbonization. The conclusion must, therefore, be to remove the primary products as quickly as possible from the danger zone.

One method for attaining this last-mentioned object is the admission of blue-water gas to the retorts. It may also be considered that coal gas should be used for the same purpose provided it has gone through a complete stripping process, so that the heavy hydrocarbons are not unnecessarily exposed to the high temperatures. One might even think of combining with such recirculation the conversion of paraffin hydrocarbons with those of the aromatic series—seeing that the production of the former is favoured by the rapid removal of the gas from the retort.

BENZOL EXTRACTION.

The practice of extracting benzene and other aromatic hydrocarbons from the gas for war purposes has undoubtedly come to stay, and will in future form a valuable bye-product in the carbonization of coal. Its removal from the gas is a mode of lowering its calorific value, which is in every respect preferable to the addition of inert gases. Although benzol extraction reduces the heating value (particularly the illuminating power) of the gas, it offers the distinct advantage of making the gas more uniform.

For coal gas, as we know it, is a mixture of permanent gases and vapours very much on the lines of "petrol air gas;" while the latter is nothing but carburetted air—the vapour carrier in the former is itself a combustible gas. It will be seen from Table I. that both the calorific value and the oxygen requirements of the vapour portion are very different from the corresponding figures for the gas portions. While the actual percentage of the whole vapour portion amounts to only about 1 p.ct., its calorific value, and particularly its oxygen requirements, approach 10 p.ct. of the total. This proves that by the removal of the vaporous hydrocarbons, greater uniformity is obtained. An incidental advantage is the removal of sulphur compounds from the gas, and that of naphthalene which should be practically complete.

TABLE IV.—*Showing the Effect of Complete Vapour Extraction on Calorific Value.*

Combustible.	Inert.	Total Gas.	B.Th.U. per Cubic Foot Gas.	
			Unstripped.	Stripped.
Per Cent.	Per Cent.	Per Cent.		
100	..	100	653	612
95	5	100	620	581
90	10	100	588	550
85	15	100	555	520
80	20	100	522	489
75	25	100	490	459
70	30	100	457	428
65	35	100	424	398
60	40	100	392	368
55	45	100	359	336
50	50	100	327	306

Just at present a good deal of the enriching qualities of these vapours is required merely in order to counteract the lowering influence of the non-combustible gases. With a reduction of these to a minimum, the necessity disappears of leaving the enriching hydrocarbons in the gas. From Table IV. it will be seen that even after the complete extraction of benzene, toluene, xylene, naphthalene, and carbon bisulphide, gases of very appreciable calorific values can be obtained by the reduction of inert matter.

It will also be seen that, after complete stripping, the calorific value is only lowered by 6·3 p.ct. Benzol in the liquid form is of much higher value than when incorporated in the gas in vapour form. A rough calculation will prove this:

2 gallons of benzol . . . . at 6d. per gallon = 12d. per ton.
120 c.ft. of benzol vapour (1 p.ct. of gas) at 3s. standard price = 4·3d. ,,

As regards carbonizing methods Dr. Lessing states that progress must lie in the direction of a more complete realization of the intrinsic value of coal in the form of its various products. He does not believe that the craving for high gas makes is a step in the right direction. A more complete recovery of liquid oils will comply with our future economic requirements, and which can, if needed, be converted into gas or liquid hydrocarbons of other types by a secondary operation. If this assumption is correct, it would indicate the necessity of carbonizing at lower temperatures, which would probably lie somewhere between those at the present time employed and those proposed by the Coalite and other low-temperature carbonization processes. There is a need for research on a very extensive scale in order to find out the optimum conditions which govern the process of carbonization in one direction or another. Such research should be in touch with the investigations on the quality of gas as supplied; and it will be the business of the carbonizing engineer to devise plant on the basis of research which will produce the maximum value of products from the coal.

In view of the desired conservation of our fuel supply, the tendency should be to burn as little coal as possible in its raw state, but to pass it all through the carbonizing process for the recovery of the products, leaving the coke for those industries which will still require a solid fuel or for conversion into producer gas. This would indicate the necessity for caution in the extension of water-gas making, as thereby the most valuable solid fuel would be removed from the market and the replacement of coal by a smokeless combustible would be further inhibited. For this and the other reasons specified previously, Dr. Lessing believes that water gas should never be more than a subsidiary adjunct to coal gas manufacture and should not replace coal gas itself.

In conclusion, Dr. Lessing states that on the whole he favours the production of a gas which complies with the following conditions:

1. The gas should be made on a calorific basis.
2. All aromatic hydrocarbons, including naphthalene, should be extracted from the gas.
3. The unsaturated alipathic hydrocarbons, olefines, and acetylene, together with the small portion of aromatic hydrocarbons necessarily left in the gas by reason of their vapour pressure at the ordinary temperatures of extraction, will ensure sufficient luminosity for most lighting purposes where gas is used in flat-flame burners. In cases where high illuminating value is needed and incandescent mantles cannot be employed, carburettors should be used either for single burners or as a complete installation. A return to the old albo-carbon lamp might be of advantage in such cases. Special carburation—preferably (for economic reasons) with naphthalene—should also be considered for industrial applications requiring extra high temperatures.
4. For the bulk of its uses town's gas need not have a calorific value higher than that of completely stripped straight coal gas (550 B.Th.U.); and with more than 90 p.ct. of the gas supplied the calorific value may fall well below this figure.
5. The percentage of non-combustible gases should be reduced to a minimum possible under present conditions; and ways and means should be found to reduce this percentage further, as well as other impurities.
6. A gas make of approximately 12,000 c.ft. per ton of coal can be obtained without dilution with non-combustible gases by avoiding extreme cracking and the formation of any retort carbon and lamp black.
7. The interests of the gas industry and of the consumers will be best served by the supply of a uniform gas of high calorific intensity, not obtained by carburation—for instance, a gas containing a much higher percentage of methane than our present supply. Realizing the difficulty attaching to any proposed increase in the standard price necessitated by such a change, it is suggested that in future parliamentary proceedings the standard price should be fixed at per 1000 c.ft. of gas of a definite calorific value, and that this price should be applied on a sliding-scale for the same number of British thermal units, should it be decided to increase or decrease the calorific value within certain limits.

HOUSING AND THE USE OF GAS.

By Thos. Newton.

The inability on the part of various municipalities to build houses to meet an admittedly clamant demand has evoked feelings of exasperation among social reformers; but evidence is rapidly accumulating that foreshadows a period of strenuous activity in connection with a programme of house building in the near future on a gigantic, if not upon an unprecedented, scale. Much criticism has been levelled against the Government for not having in readiness at the time of the armistice the necessary plans, labour and materials to start building operations at once. But the critics, perhaps, did not sufficiently realize the inherent difficulties involved.

It is now stated by Sir James Carmichael, the Director-General of Housing at the Local Government Board, that the Government programme is to erect 300,000 houses within the next two years. This is pretty definite, both as regards the number of houses, and the time limit; but it can only be regarded as an instalment of what will actually be required at the expiration of two years. The probability is that when the Government programme is completed, a further quarter of a million houses will still be urgently required.

Prospective Business for the Gas Industry.

The bare recital of the scarcity of houses, and the Government's intentions concerning the building of hundreds of thousands of new ones. indicates very plainly the commercial possibilities which lie immediately ahead. It is therefore reasonably safe to assume that much prospective business for the gas industry will be readily forthcoming; and in this connection it is interesting to note that the British Commercial Gas Association are fully alive to all the possibilities.

Working Classes Appreciate Gas Appliances.

The use of gas by the working classes has always been appreciated; but during the past four or five years many working-class families have experienced the economy, convenience, and utility of various kinds of gas appliances to a much greater degree than formerly. Hence, it follows that an extended use of gas must naturally be expected in connection with the projected housing schemes.

Although many "model" plans have been devised, it is most unfortunate, and not a little disappointing, to find that even these provide for stereotyping the usual antiquated coal-consuming appliances. Modern houses should be so designed and constructed that they will best serve the purpose for which they are intended. In the past, housewives have had legitimate ground for complaint that their requirements have not been sufficiently studied; or, if they have been studied, they have not materialized. Fixtures, for example, have been installed which were obsolete from the very date of installation; and in many cases these involve labour-absorbing operations of a tedious nature. Old-fashioned coal-grates, wash-boilers, coal-ranges—with their wasteful hot-water systems—have been fixed utterly regardless of the consequent amount of labour these impose on the housewife, who is compelled to stoke and clean them incessantly in order to get anything like decent results.

Hitherto, it seems to have escaped the attention of those responsible for house planning that, although they may plan and fix these antiquated arrangements, in many cases they will never be used—preference being rightly given to the more effective and labour-saving gas appliances. It is, of course, common experience to find in any fair-sized town thousands of coal-ranges which have been entirely supplanted by the more efficient, the cleaner, and the more convenient gas-cooker. This also applies, more or less, to coal-grates, which have given place to gas-fires. And so on with regard to other kinds of apparatus. It should be constantly borne in mind that the prevailing idea nowadays is to get the maximum of efficiency with the minimum of labour. Hence the futility of too rigid an adherence to the various types of coal-fired appliances, many of which have obviously survived their usefulness, and the initial wastefulness involved in first providing coal-fired appliances, and then immediately supplanting them with gas appliances.

It may be taken for granted that the working-class population of this country intends to share more fully in the future than it has done in the past in the benefits to be derived from labour-saving inventions in the home; and this constitutes a great opportunity for the gas industry. A few misguided enthusiasts have attempted to insinuate that electricity for domestic purposes is the one thing needful to minimize domestic drudgery, and that a cheap supply will become available as soon as certain super-stations can be erected. Glowing pictures have been painted by uninformed writers which, alas! can only have the effect of raising hopes that are doomed to immediate disappointment. And none know so well as the electricians themselves that such hopes are not likely to materialize in the near future.

Utility of Gas Demonstrated for Domestic Purposes.

With gas, however, it is happily very different, since its domestic utility has been demonstrated for various purposes, on numberless occasions, and in every conceivable set of circumstances. Doubt and disappointment do not exist where gas is utilized for domestic labour-saving operations; and its benefits can be enjoyed in the immediate present, without being at all dependent on some mythical advantages wrapped up in the distant future.

Little need be said in favour of incandescent gas lighting, since this is by far the most popular light among the working classes, as hundreds of thousands of satisfied consumers will cheerfully testify. The ubiquitous gas-cooker has also justified its existence; while the growing popularity, and the extended use, of gas-fires emphasize the fact that in the modern and hygienic gas-fire we have a quick, efficient, convenient, and economical means of warming our dwellings. To have heat on tap, always available, without the attendant dirt and labour inseparable from a coal-fire, is a great desideratum. Where rooms are required only for intermittent use, as so many are, gas-fires are practically indispensable. A gas wash-boiler is much to be preferred to the antiquated solid fuel copper, with its bricks and mortar surround. It is really incomprehensible, when one comes to think about it, how the washing of clothes and linen to the accompaniment of showers of sparks, dirt, and dust, ever came to be tolerated. The provision of gas wash-boilers in a prospective housing scheme would certainly be appreciated for their labour-saving qualities. There are, of course, many methods of obtaining supplies of hot water by means of the various types of gas apparatus now on the market; and among the many advantages of heating water by gas may be mentioned that of quick, convenient, and effective service with the barest minimum of labour.

Full Use Should be Made of all Kinds of Gas Appliances.

From what has already been stated it will be seen that the exigencies of domestic economy demand that the fullest possible use should be made of the various kinds of gas appliances which are now available for the projected housing schemes. It has already been shown how, by planning and fixing gas appliances in the houses at the time of building them, much initial expenditure might be saved. But this is only one-half the story. To obtain the full advantage, the houses should be designed to suit the altered conditions. Thus, there would be no necessity to plan and build the cumbersome chimney breasts which add to the cost and diminish the capacities of the rooms they disfigure. Neither would there be the necessity to spend so much on the external chimneys. In the meantime, gas supplies should be laid to the parlour and bedroom fireplaces in readiness for the inevitable fixing of gas-fires.

AUTOMATICALLY ESTIMATING SMALL AMOUNTS OF OXYGEN AND COMBUSTIBLE GASES.

A recent number of "Engineer" points out that in the course of their investigation of the synthetic ammonia process, conducted at the Munitions Inventions Department, Dr. H. C. Greenwood and Mr. A. T. S. Zealley devised an automatic apparatus which indicates the amount of oxygen present in the nitrogen and hydrogen, and also gives a warning when the percentage of oxygen—which would interfere with the catalysis and might cause explosions—exceeds a certain value. The principle of the apparatus is that, when a known volume of the gases is left in contact with a hot platinum wire, electrically heated, the oxygen will burn an equivalent amount of hydrogen, and the gas volume will hence be diminished. From the contraction, the percentage of oxygen can be estimated; and the rise of the mercury in the respective glass tubes can be made to close the circuit of an alarm bell. On the other hand, the presence of small quantities of hydrogen or other combustible gases in air can likewise be detected in this way; and the amount of methane in mines may be estimated by the same method. The apparatus, described in the "Journal of the Society of Chemical Industry" for April 15, consists of a system of glass tubes, partly filled with mercury and water, working on the syphon principle. The first operation makes the mercury rise, to open and then to close the gas burette, which thus becomes filled with the gas mixture to be tested. The electric current is, at the end of this first phase, automatically switched-in, and the thin platinum wire in the burette is rendered red hot. White heat, it has been ascertained, is not needed for the combustion. The second operation cuts off the electric current; while the third allows the mercury to sink to its original low level. The burette is then cooled by the water flowing through its jacket; and the burette is several times flushed with fresh gas mixture and kept refilled for a new analysis. For a burette of 50 c.cm. capacity the rate of gas flow through the apparatus need not exceed 1 c.ft. per hour. Absorbent liquids or solids are not used. The apparatus, which fits into a small glass-fronted case, has given very little trouble in continued practical operation. As described, the apparatus—not novel, of course, in principle, but novel in its automatic operation and compactness—would be very convenient for automatic testing in cases where only one combustible gas is to be reckoned with; and the apparatus is valuable in particular also because it furnishes a continuous automatic control of the purity of the gases used in continuous processes. A test takes a few minutes, and 0·1 p.ct. of oxygen can be detected.

Nitrate of Soda Order Suspended.—The Minister of Munitions has suspended, as from the 15th inst., the Nitrate of Soda Order (dated Oct. 18, 1917).

THE CHEMIST AND ENGINEER.

Need for Collaboration.

In a paper submitted by them at last Tuesday's meeting of the Institute of Petroleum Technologists, Dr. F. Mollwo Perkin, F.I.C., F.C.S., and Mr. T. C. Palmer, Assoc.M.Inst.C.E., dealt with the need for collaboration between the chemist and the engineer in dealing with problems connected with different industries. From the latter portion of the paper, the following has been extracted.

Working Temperatures.

The production of by products from bituminous materials may either be by low-temperature or high-temperature carbonization —the latter being the gas-works operation. But this admits of many modifications. The low-temperature processes are more or less in their infancy. Many of them have not yet left the cradle. It is here that the chemist and engineer have a very difficult problem. The chemist, from his knowledge of the properties of coal and the action of heat under varying conditions, must co-operate with the engineer in the design of the retort or oven for carbonizing. Even yet, after all these years of gas manufacture, we are woefully ignorant of the constitution and properties of coal. The erection of the gas-works has been mainly carried out by the engineer, and the chemist has not been sufficiently in evidence.

A great deal can be learned from the important research work of Dr. R. V. Wheeler and Dr. Marie C. Stopes, whose most valuable monograph on the constitution of coal has recently been published. This is the work of the pure chemist, which no engineer could have carried out. In this connection, the chemist has to go still further, and put the facts concretely before the engineer, so that a process can be evolved for translating this knowledge to the national benefit. It must not be supposed that this can be done without a large amount of careful research both on the part of the chemist and the engineer. The oils obtained by low-temperature carbonization are very different from those obtained from the earth by boring; and the methods of refining cannot therefore be the same. These oils approach the shale oils—that is, they contain a large amount of unsaturated hydrocarbons, and, like cracked spirit, contain also poly-olefines and similar bodies which have a tendency to polymerize and become gummy. Ordinary methods of refining will not remove these without at the same time destroying a large amount of the other hydrocarbons. Here, then, the chemist must carry out the research, and when a satisfactory method has been evolved, the engineer will co-operate to work out the most satisfactory plant to be employed on a large scale.

There is also the designing of the retort or oven so that the carbonization may proceed evenly, and at the same time a good thoughput be obtained. Close co-operation between the chemist and engineer is necessary here also.

Oil-Shale Distillation.

One of the most interesting examples of the foundation of an industry by the collaboration of the chemist and the engineer is to be seen in the distillation of oil-shale as practised in Scotland. This industry was initiated in England by the chemist James Young, in 1847, and then largely taken up in America. In fact, when oil was first obtained by drilling, which resulted in the production of more oil than could be used, there were a large number of shale-retorting plants in operation; but, owing to the competition of the natural oil, many had to shut-down.

In the early days of shale retorting or distilling, very little consideration was given to economical production. The uncondensable gases produced from the shale were allowed to pass into the atmosphere. The ammoniacal liquors produced were considered of so little value that, not only were they run to waste, but they were considered an unmitigated nuisance. Then the industry entered upon a period when, owing to the competition of American natural oil, economies had to be introduced or the industry go-under. Economies and changes in methods of distillation and plant were gradually introduced, in which the exit of vapours was effected at the bottom of the retort instead of the top, and arrangements were made for utilizing the uncondensable gases for heating.

Other improvements were made in the retort-settings, so that the spent shale could drop out of the bottom from a combustion chamber where the carbon was gasified by means of steam, and utilized for supplying the greater part of the heat for distillation. A large recovery of ammonia was also obtained by the same treatment.

The importance of sulphate of ammonia as a fertilizer was beginning to be realized; and its production practically saved the Scottish shale-oil industry. Further improvements in process and plant were made at various times, the result at the present day being that we have an economical and efficient vertical shale-retort, heated by the uncondensable distillation gases, with producer gas as an auxiliary fuel, also mechanical devices for charging and discharging and removing the spent shale.

A study of the shale industry is a good example of the application of science and practice when properly directed, and shows the enormous importance of the combined efforts of the chemist and engineer as applied to the Scotch oil-works.

Problems to be Elucidated.

The chemist and engineer have, by collaboration, produced the various products of the petroleum industry. The question arises, Has the collaboration been close enough? Cannot better results and better products be obtained by a still closer brotherhood? There are certain problems of great importance which have to be elucidated.

1.—How is sulphur to be removed from oils obtained from shales containing a large percentage of this element? We are here dealing with a very difficult problem. The shales are distilled at a more or less low temperature, which produces a large amount of unsaturated hydrocarbons, mainly of the olefiant series. Drastic treatment to eliminate the sulphur would probably also decompose the unsaturated hydrocarbons. It is for the chemist to devise a scheme for treating the oil; and he will then call in the aid of the engineer to design the plant. It must be remembered that the sulphur is united with hydrocarbons, some of them of very high molecular weight. If these compounds have to be absolutely disrupted or broken-down in order to eliminate the sulphur, the loss of oil will be very great.

2.—Low-temperature carbonization of coals and cannels also yields oil containing a large quantity of unsaturated hydrocarbon and poly-olefines or substances which polymerize to form viscid or gummy materials, also large quantities of phenolic bodies. As commercial-scale tests are about to be made on low-temperature carbonization, the chemist must devise suitable refining methods. The engineer will assist with the plant both for refining and for carbonizing.

We consider that life is too short for the chemist to be his own engineer, or for the engineer to be his own chemist.

LIQUID PURIFICATION OF GAS.

A writer in the American "Gas Age" says that during the past winter an opportunity presented itself to him to secure some first-hand information regarding liquid purification for the removal of sulphur from gases coming from the oil-stills of a refining company. This gas contains as much as 8000 grains of hydrogen sulphide per 100 c.ft. of distilled gas. It is composed of hydrocarbons mixed with some air, and runs as high as about 55 candles. The tests were conducted in a careful and scientific manner; and some account of them is given by him.

The installation consisted of two towers, 3 ft. diameter by 30 ft. high, each filled with 136 c.ft. of 3-in. helical glazed earthenware brick, consisting of a cylinder 3 in. in diameter and about 3 in. high, with an interior helix. The bottom of each tank was sealed in a 1500-gallon tank filled with a mixture of iron oxide and water, which was pumped to the top of the first tower, and sprayed down through an ascending current of gas. The foul oxide leaving the base of the first tower was then pumped into the top of the second tower, and allowed to flow down through an ascending current of revivifying air. From the tank at the base of the second tower, the revivified oxide was pumped to the top of the first tower, thus affording a continuous circuit in which the oxide was alternately fouled and revivified. The iron in the mixture in the tanks was prevented from settling by air agitation, which later became the only source of air for revivification. It was soon evident that the ability of a single tower to revivify oxide by blowing air through it had been considerably over-estimated; and so the two towers were used in series for purification—the revivification of the oxide being accomplished by the air employed for stirring. The oxide used was a precipitated oxide containing 24 p.ct. of moisture and 41 p.ct. of Fe_2O_3 on a dry basis. When completely fouled, it contained on a dry basis as much as 89 p.ct. of free sulphur, and only 7 p.ct. of Fe_2O_3.

As an example of the results obtained, it was found that, when passing 4000 c.ft. of 2100-grain gas per hour, using 70 gallons of liquid per minute through each tower, the hydrogen sulphide was reduced to 132 grains per 100 c.ft. One of the general conclusions arrived at was that cold liquid purification of a very high candle power oil gas may result in a loss of 25 p.ct. in candle power, and in a lower candle power oil gas of as much as 6 p.ct. However, if this gas is purified at a temperature of about 130° Fahr., the loss in candle power will be not over 2 p.ct. It is, indeed, possible that the loss in candle power by the liquid purification of ordinary illuminating gas would be even less than 2 p.ct. at a temperature of about 90° Fahr.

At a meeting of the Governing Body of the Imperial College at South Kensington, it was announced that an old student of the Royal College of Science had contributed £8000 for the equipment of an intermediate scale laboratory in organic chemistry, a new building for which is now in course of erection.

Friday of this week has been fixed for a more or less informal meeting, at the Westminster Technical Institute, Vincent Square, of the London and Southern District Junior Gas Association. Several subjects are down for discussion; and refreshments will be served during the evening, by invitation of the President (Mr. S. B. Chandler). Then on Saturday, June 28, there is to be a visit to the works of the Hampton Court Gas Company, at which ladies are specially invited to be present. Tea will be provided by the Company.

BRISTOL CONFERENCE OF THE "B.C.G.A."

A successful conference, at which (through the hospitality of the Lord Mayor, Alderman H. W. Twiggs) very agreeable social intercourse was blended with practical business topics, was held by the British Commercial Gas Association at Bristol last Tuesday. The conference took place in the Board-room of the Bristol Gas Company, whose Chairman (Mr. J. H. Howell) was President. He was supported by his co-directors; and there was a good attendance from West Country gas undertakings. After the conference, the local arrangements for which were under the supervision of Mr. S. E. Halliwell (the Secretary of the Bristol Company), tea was provided. In the evening, a lecture by Prof. Leonard Hill, at the Museum Lecture Theatre, was preceded by a reception by the Lord Mayor and the Lady Mayoress, at which representative citizens and their lady friends were present. An orchestra provided a good selection of music; and the Art Gallery and Museum afforded special interest to the visitors, who after the lecture enjoyed refreshments provided by the Company.

A Welcome.

The Lord Mayor attended at the opening of the conference, and extended a very warm welcome to the members. He said the businesses they represented were important ones, entering very largely into the social life and amenities of the country, as well as into its commercial aspects. Bristol was among the earliest cities in the country to look into the matter of the use of coal gas for lighting, heating, and possibly for power purposes. Over a century ago the city took a very active part; and during all the time the Company had been eminently successful, because they had always been led and managed by some of the most eminent citizens. He was very glad to welcome representatives from the West of England there, because he thought they would find the city full of activities, and quite alert to commercial ideas and advancements. He expressed the hope that their deliberations would be productive not only of personal benefit, but of developments beneficial to the community at large and to the furtherance of the general prosperity of the country.

The Chairman proposed thanks to the Lord Mayor for his presence.

The vote was heartily carried.

The Chairman then welcomed the members on behalf of the Bristol Board, and said it was good that they had selected Bristol for the conference, because it was the largest city in the West of England, with nearly 400,000 inhabitants. It was a city of great traditions, and it was one of the first places to adopt the manufacture of coal gas. In the room was a portrait of Mr. John Breillat, who in 1811 kept a dyer's shop in Broadmead—a street about 700 or 800 yards from the Board-room. He had seen, it was supposed at the Soho works of Bolton & Watt, a plant that William Murdoch had installed. In September, 1811, he announced, through the "Bristol Gazette," that on that evening and on subsequent evenings he would exhibit the new illuminating gas in his shop. On several nights in succession he lectured and gave illustrations with the gas. He also in 1811 put up a few lamps in the street in which he lived, thereby anticipating by one year the installation of gas-lamps in the City of London—the first of which were erected on Westminster Bridge in 1812. This gave Bristol the prescriptive right to regard itself as more or less a pioneer, as in 1812 London followed suit. In the meantime, Mr. Breillat, like all pioneers, had to undergo a certain amount of obloquy. In 1816 he was able to get a small group of men together, and they started what was then called the Bristol Gas Company, with a capital of £5000. London again followed suit; and in 1816, Bills were promoted in Parliament for the illumination of the streets of London. They would not be surprised to hear that Lord Lauderdale protested strongly against the illumination of London by gas, because it would destroy the whale fishing industry. Still more extraordinary, that great discoverer and scientist, Sir Humphry Davy, absolutely sneered at the proposal to light the streets of London with gas, because, he said, "they would have to turn the dome of St. Paul's into a gasholder." In 1817, thanks to the energy of Mr. Breillat, a few shops were lighted in Bristol; and in 1819 an Act of Parliament was obtained by which the Bristol Gas Company was incorporated, with a capital of £50,000. The gas was very bad. It was malodorous, and the illumination was imperfect. In consequence, a rival company was started, called the Bristol and Clifton Oil Gas Company. This company had a total capital of £30,000, and began operations by charging 40s. per 1000 c.ft., and maintaining that 40s. oil gas was better than the 15s. gas the Bristol Company produced. They went on for ten years, paid no dividend, and eventually abandoned the distillation of gas from oil, and applied for power to produce it from coal. An arrangement was come to between the companies that they should carry on rival concerns, and that the price of gas should be 12s. per 1000 c.ft. This went on until 1853, when they had come to the conclusion that reckless competition was unwise. They amalgamated, and the concern became the Bristol Gas Company, of which the Directors present were the representatives. This was a short history of the production of gas from its earliest institution in the city. Now he would draw on their imagination for a moment, and assume that John Breillat might revisit the glimpses of the moon as a shade. And what would he find? He would learn that the capital of the Company, fully-paid up, was now £1,625,790, that the gas made last year was 3,286,000,000 c.ft., that the coal carbonized approximated to 300,000 tons, that the oil consumed was from half to one million gallons for the production of water gas, that there were 380 miles of mains, that the gasholder capacity was 15 million c.ft., that there were 58,689 cookers on hire in the district, that the gas-meters so far fixed numbered 69,084, of which the prepayment meters were 32,870. The price of gas, which started at 15s. per 1000 c.ft., was reduced to 12s., and had gradually fallen until, in pre-war days, it was 2s., with liberal discount to those who consumed more than half-a-million cubic feet, and 1s. 6d. per 1000 c.ft. for power. In spite of the enormous advances with which they had had to contend, their price now for illuminating purposes was 3s. 3d., with a liberal discount to those who consumed more than half-a-million cubic feet. and 3s. for power. Carrying it a little further on, if John Breillat were to come back, he would find that their horizontal retorts were now charged and discharged by mechanical means, that inclined retorts had self-feeding coal appliances and self-discharging coke appliances, and that the last and crowning introduction in the manufacture of gas was the vertical retort, whose capabilities were even now hardly appreciated. As a dyer, Breillat would be astonished to find out all the bye-products, the most beautiful colours and synthetic dyes, which were now produced, and which he, as a small dyer, could not have conceived possible. He would also find that they had produced toluol and benzol for high explosives, and that motor cars and omnibuses were propelled by the gas feeding of internal combustion engines. When he had found out all this, like Hamlet's father, he would very probably be glad to go back to the shades, and think he had passed a very extraordinary experience in twenty-four hours. The main object of the meeting was to discuss the future of gas and its proper understanding by the masses of the people which the British Commercial Gas Association had in mind. They had to educate the people. They had to spread the light, and convince them that gas was one of the most beneficent instruments yet discovered, and that there were one-thousand-and-one uses for it.

Alderman George E. Davies, the Vice-Chairman of the Bristol Gas Company, associated himself with the welcome. He and his colleagues were glad to have the opportunity of discussing the immediate future of their undertaking, and the responsibility which must lie upon them in connection with it. They had the double responsibility of being answerable to their shareholders on the one hand and to the public on the other. So far as the shareholders were concerned, they all realized —and it was well that the public who were their customers should realize—that their responsibility to them was a very limited matter; that they were unable to work in the way an ordinary commercial business would work for a large profit. They, as a statutory company, had their dividends limited to a modest 5 p.ct.; and sliding-scale companies had to put up with a smaller dividend through the difficulties caused by high prices and war conditions. They were trustees for the public; and those interested in gas companies would know that their responsibilities had increased to an enormous extent during the war. They had had to give their thoughts in directions which, in normal circumstances, had not been necessary. They were constantly called upon to alter the conditions under which gas was produced. They were called upon to take from the gas certain ingredients which were required for the use of the war. The wider need of the nation had to take place above everything else—the needs of the shareholders or the ordinary users of gas. They were called upon to provide materials for high explosives which only gas could give. The industry as a whole was to be congratulated, and had been congratulated by all the authorities who had dealt with the subject, headed by Lord Moulton as representing the Government, on the way they responded to the call made for the extraction of toluol and benzol. This affected the lighting standard of gas, and efforts had been made in many directions, and not least in Bristol, to show that this was really a money-making matter so far as gas companies were concerned. They knew perfectly well that this was not true. So far as the Bristol Company was concerned, the amount received for the toluol and benzol that they had extracted had not yet been sufficient to pay for the outlay they had to incur in order to make the extraction possible. He would like to be clearly understood, when they were accused of profiteering by taking out this product, that it was only done under compulsion of the national need, and not in the slightest degree as a commercial proposition. It was well they should all understand this, and that it should be understood in the city. The difficulties of gas companies all over the country during the war time were due to the varying of the process of gas making. The question of coal supplies and coal quality had been things with them all along. Coal supplies had been an anxiety right through the war; and only those who were responsible for keeping gas lighting going knew what an anxiety it was. At times they had only one or two weeks' supply of coal and in some cases even less, and nothing between that and darkness. Conditions as regarded supplies of coal were improving; but there was a much greater difficulty as regarded the quality of the coal from which they were suffering at the present time. Instead of being able to get the best gas-making coals, they had to take steam coal, house coal, and, in some places, coal which it was difficult to define except as "dirty" coal. If they had to take this dirty coal with 20 p.ct. of ash in it, they were working under very great disabilities and difficulties, and placing an increased responsibility on the engineer and others. They were still working under these conditions. With the control the Government were exercising in the distribution of coal, they had still to put up with whatever they chose to give them, and did not get what they wanted. They would all welcome the cessation of control, and to be allowed to treat the matter as a commercial proposition, and to be able to select that which was most suitable for the purpose for which they intended it to be used. Another difficulty with regard to coal had been the price. Of course, everybody had had to increase prices during war time; and the anxiety before them at the moment was how far they might be able to keep the price at what it was to-day. They had had constant rising in the price of coal, and increased demands on the part of the miners. What the effect of this would be was uncertain. What struck him was that while in the United States there was a very largely increased output of coal per man, they in this country had had, unfortunately, a decreasing output. So that while in 1886 the output per man was 315 tons, in 1918 it only averaged 235 tons per man. They had been told that men who worked shorter hours were able to work with greater intensity; but they could not look with much confidence, having regard to what had taken place in the last ten or fifteen years, on the suggestion that shorter hours and increased wages was any reason why they should get a larger output of coal. In the absence of an increased output, there was a danger of increased prices all the time. While they hoped shortly that the difficulties of war time would have passed, they still had the responsibility and anxiety as to what the future policy should be in regard to the quality of the gas

they should manufacture, and what they should aim at. They had before them the very valuable report of the Fuel Research Board; but they had to recognize that the Board had not yet definitely reported to the Government on the very question which the Government requested them to report upon. They were asked to say what was the most suitable quality of gas for general use. This question had not yet been finally answered. But, on the whole, the report was one that deserved very great respect from all in the gas industry as one coming from competent men of independent judgment. The outstanding feature of the report which they would all welcome was the clear recognition in it of the value of coal gas as the most economical form of distributing heat energy. This was the great thing they had to congratulate themselves upon. They had in this not merely a trade advertisement, but the distinct pronouncement of a scientific fact put forward deliberately by the most competent people in the country to give a scientific opinion upon this matter which affected them all. This pronouncement should be of the greatest benefit to all gas undertakings, and it must be a benefit to the public, because they stood there as purveyors to the public of that which they required. It was difficult or impossible for the gas industry at this moment to decide what its ultimate policy should be as to the quality of gas which it should make, and what it should aim at—whether it should endeavour to make gas at a higher lighting standard or whether it should aim at the development of the greatest amount of heat—get the greatest number of thermal units. Until the Government were ready to make their pronouncement after receiving the report of the Fuel Research Board, it was impossible for them to make up their mind what policy to pursue. He hoped in mutual conference they might help one another the better to carry out the responsibilities entrusted to them, both by their shareholders and the general public.

WORK AND POLICY OF THE ASSOCIATION.

Mr. F. W. GOODENOUGH (the Chairman of the Executive Committee of the Association) then gave an address respecting the work and policy of the Association. He said it was a very great pleasure to be with them, both in his personal capacity and in his official capacity. In his personal capacity, it was a particular pleasure to him to find himself in Bristol, the chief city of the West of England, because he was a West of England man. Mr. Howell made kind references to him, which he only wished he deserved, and for which he thanked him very much. The Association was working for the industry in all parts of the country. It was a truly British Association, and not merely a London Association because it had its headquarters in London. They derived their revenue from all over the country—from the North of Scotland to the extreme West of England. This was the first conference of the Association in the South West since the war. Bristol contributed to the Association over £400 a year, which was the best practical evidence they could give of their belief in what the Association had done, and could do in the future. What they asked was that all, according to their magnitude, should subscribe likewise. What did the subscription to the Association really amount to? Worked out, it came to about a penny per consumer per annum. This was not a very serious sum to ask any undertaking to spend on a national publicity scheme for the education of the gas consumers throughout the country. They were there that day to ask those who were not already supporting the Association to come in. The results of its work were felt in the district of every undertaking, whether that undertaking was subscribing or not. Their work, he thought, was more necessary now than ever. Alderman Davies referred to the falling output of the coal mines. Increased output was the crying need of the nation to-day, from one end to the other. ["Hear, hear."] Unless they increased the output of wealth in this country, they would never be able to wipe off the debts incurred by the war; and they could not satisfy the reasonable aspirations of the working classes to have a fair share in the good things of life, unless these good things were produced.

They were suffering very much to-day from a wrong deduction from the economic law of supply and demand—the law that if supply be less than demand there is a tendency for prices to rise, and if demand is less than supply prices tend to fall. The deduction that has been made by so many people from this was that the wise and profitable thing to do was to restrict supply in order to keep up prices; whereas the true deduction to be made from that law was that one should seek to increase demand in order to sell more. ["Hear, hear."] They should create demand. Prove to the public that they need what the industry had to produce—create the demand, and let the supply follow. Bristol did more business to-day, and made more profit, by selling gas at 2s., than they ever did by selling it at 15s. or 40s. It was not high price but big sales that brought large profits. This excursion into the realms of economics was not without relevance, because the function of the British Commercial Gas Association was to create a demand for the gas the industry existed to supply by its publicity campaigns—by both its national campaigns and district campaigns in papers that had a wider circulation than the area of any single undertaking, and also by rendering assistance to the individual undertakings in initiating and carrying out local schemes for developing sales. They were going to hear presently something of a scheme that the Executive had been working out for making the Association much more actively useful to individual undertakings than in the past in the direction of the organization of selling. What was the prime, the first consideration of every business man? Surely it was to sell, to create his market, to get his demand; and then afterwards to proceed to manufacture. The gas industry had suffered in the past from the fact that a certain amount of demand had been created for each undertaking by the giving to it of a monopoly of supply, and from the fact that the officers principally in charge of the undertakings had been professional engineers who had quite naturally thought more about the technical side than the commercial side.

This was natural in an industry which was based upon engineering; but it was a weakness both in the gas industry and, fortunately, in the industry with which it had to compete. The electrical industry suffered more than the gas industry from the fact that its destinies were so largely in the hands of technical men. There was much less leaven of commercialism in the electrical industry than in the gas industry; but their competitors were beginning to wake up to the disadvantage of this fact. They had just paid the B.C.G.A. the compliment of imitating them, and had started an Electrical Development Association avowedly to counteract, or endeavour to counteract, the activities of this, as they thought, malign organization. A good many of those engaged in the gas industry had realized, and all needed to realize in an increasing degree and to keep ever in their minds the fact that they were just as much in business or trade as if they kept a shop and sold goods over the counter. Gas undertakings did keep a shop, and not merely a works. They sold something, and had to apply the methods of salesmanship to the selling of gas and bye-products just as much as if they were selling anything else. They must get as far away as they possibly could—a great many of them had got a long way away—from the old *laissez faire* policy, the policy of letting well alone. Pushing business took a lot of time and energy; and they were apt to say, "We have got an increase in output, why not leave it at that?" They had always to remember that what they were aiming at was not what was just good enough, but what was best, and not to be content with anything short of the very utmost. Alderman Davies referred to the monopoly the gas industry possessed as creating them trustees of the public, as well as of the shareholders. This was a very sound observation, which everyone should take very much to heart, because possessing a monopoly of supply seemed to him to put upon them duties as well as rights; and one of the most important duties was that of developing the business to the greatest possible extent. If they did not do this, they could not supply the public they were given the sole right to supply with what they made at the lowest price. Increased output always meant a falling price. To increase output to the fullest extent they must always act on the policy of satisfying the consumer. It was the consumer's money that paid wages and salaries; and if the staff of an undertaking did not satisfy the consumer, and sell as much gas to him as they might—if he was not satisfied—he would not buy, if he could help it, and there would not be the money to pay wages and salaries. They were engaged in the business of selling gas. He would urge upon them all the importance of always trying to see the other man's point of view, of trying to get into the other man's skin and seeing how he would view what they wrote or said to him and anything they printed for him to read. They should always try to see the other man's point of view when they got a letter of complaint—should regard it as a great opportunity rather than as a nuisance, an opportunity to turn a disgruntled man into a friend, and to do more business with him.

Let them always feel when they got a complaint that it opened the door to go in and talk business to the consumer—an opporunity they might not otherwise get. If every employee of an undertaking realized that he was really the employee of the consumer that he had got to deal with, he would not ever fall into the mistake of being a little "Jack-in-Office," and thinking that because he served a big company and the consumer appeared to be a small person it was either clever or wise to treat that consumer in anything but the most considerate and courteous way. The consumer had to be satisfied that he was getting a "square deal." There must be a sense of mutual profit on both sides. It seemed to him the great blunder Parliament made in treating the industry so badly in regard to the Temporary Increase of Charges Act of last year was that they did not appreciate the fact that there had got to be profit on both sides in a bargain. They did not give the gas industry a square deal from the gas industry's point of view. Emphasizing the good work already done by the Association during the war, he said they did a great deal to assist the public in the question of food economy and food production by working with the Food Production Department. They had been paid an unprecedented compliment by having their pamphlet on fuel economy adopted by two Government Departments—first by the War Savings Committee, and afterwards by the Board of Trade—as truly presenting to the public the facts with regard to fuel economy; so that they were supplied with some millions of copies of the pamphlet at Government expense. A much more important thing than the work done in the past was the question of the future. There were three problems that were very much in the public mind at the present moment—housing, transport, and coal conservation. If they could get the facts known throughout the country as to what the effect upon the coal supplies would be by substituting electricity for gas or coal for heating and cooking purposes, he thought the schemes that had been so lightly talked about would very soon be dropped. The speaker then summarized the facts on this subject and said that these were facts which they particularly wanted to be considered by housing authorities. The Association had done a good deal so far by the preparation and circulation of literature bearing on the subject of gas in relation to housing problems, which had been taken up by a large number of gas undertakings, and circulated

with successful results among housing authorities up and down the country. Apart from the houses that were going to be built, in the houses that existed to-day there were 40 million tons of coal being used in its raw state, as compared with 20 million tons being carbonized in the gas-works; and to capture this trade—the trade of the consumers who were now using raw coal—would mean trebling the output of the existing gas undertakings. By doing it, moreover, the saving to the community he estimated at 10 million tons of coal a year. To give the gas consumers equal service to that rendered them for a distribution, net, of 10 million tons of coal, the electric generating stations of to-day would destroy 40 million tons, and the super-stations 20 million tons at least; and in so doing they would destroy all the valuable bye-products recovered when coal was carbonized. There was no ground for pessimism as to the future of the gas industry, if they rose to their possibilities and their opportunities. If gas and coke took the place of coal, there would be an enormous saving in transport.

Mr. R. M. Rowe (Ilfracombe) proposed a vote of thanks to Mr. Goodenough for his address, and said if the gas industry had ransacked the kingdom they could not have found a more able and energetic man to fill the office of Chairman of the Executive Committee. As a director of a small company in the West of England, he had watched with great interest the reports that had been published from time to time of the work done by the Association; and he was sure they could not find a man more capable, or whose heart was more in the industry. He had made some reference to the Government not having given the gas industry a square deal in connection with the Act which was passed last year. Much of the reflection in this direction was accounted for by the fact that there was not sufficient representation in the House of Commons at that time in order to induce the Government to do justice to the industry which had done so much for the country during the time of its extremity. He suggested that the Executive Committee might very usefully apply themselves in the direction of endeavouring to find a greater number of friends of the gas industry in the House of Commons, in order to obtain the support and confidence which the industry was clearly entitled to receive from the Government.

Mr. W. Aitken (Torquay) seconded and Mr. J. Wesley Whimster (Bath) supported the motion.

Mr. W. M. Mason said that the Association was in every sense a business organization. Unknown to Mr. Halliwell, he inquired some time ago of a big bookselling organization in Bristol, and found that the number of publications in which the Association were regularly advertising which were circulating in Bristol was between sixty and seventy. The Chairman of the Company might think that a subscription of £400 was a tremendous amount of money; but Glasgow paid £1045 a year, and did not do so without looking at both sides of it. One London company gave £3500 a year, because it was a business organization. How far would £400 go in paying for advertising space in the sixty or seventy papers to which he had referred? If they wanted to advertise on a decent scale in half-a-dozen papers, £500 would hardly be seen. They had one of the finest business organizations in the world.

The resolution was heartily carried.

Mr. Goodenough briefly replied.

Development of the Sale of Gas.

Mr. F. H. Holland then gave an outline of the Association's scheme for sales organization [see *ante*, p. 307]:

Mr. S. E. Halliwell (Bristol) proposed a vote of thanks to Mr. Holland, and complimented the Association on securing his services to give practical and expert assistance to gas authorities who were organizing special sales campaigns. This was a distinct advantage, as gas officials generally were finding it increasingly difficult, with their multitudinous duties, to concentrate on work of this description, and prepared schemes would be of the greatest service. Many underakings had, of course, carried out successful schemes for the extension of their business in the past; but there was ample room for further enterprise on well-devised and scientific lines. He quite agreed that much of the canvassing in the past had been done in what might be rightly termed a haphazard fashion, resulting in unnecessary inquiry; and the scheme as outlined would ensure the circularization of consumers on matters in which they were directly interested, with better prospects of business. Another distinct advantage of a census of consumers was that the gas undertakings that carried out the scheme thoroughly and systematically would have in their possession, for reference, valuable information as to the conditions under which the various buildings were at present supplied in relation to the gas apparatus already installed. By far the largest percentage of complaints was due to defective fittings, particularly in the older properties; and cases in which existing appliances were antiquated, or where they were not being used under conditions which gave efficient and satisfactory results could be dealt with. Consumers would appreciate this attention, and they recognized that a satisfied consumer was their best advertisement. Gas service, as distinct from the mere sale of gas, was the ideal policy to ensure stable business. Incidentally, the further development of local sales of coke could be included in the scheme; and in view of the fact that coke sales were such an important factor in their balance-sheets, the general introduction of a more systematic method of dealing with this residual would have good results. The scheme depended largely upon the manner in which the staffs carried out the details, as interest and enthusiasm were required to bring it to a successful issue. He thanked Mr. Holland for his address, which would receive the fullest consideration, as it affected them in their particular districts.

Mr. F. A. Pye (Chester) seconded, and said that the Association had tried very hard to develop organization on intelligent lines in recent years. Although at the moment they might not see the supplies of coal available for the development they would wish for, in trying to develop gas consumption they might perfectly honestly feel that they were studying the real and true national interests. By no other method than that of carbonizing coal in gas-works and coke-ovens could they secure from their most valuable natural commodity all the bye-products which were available. Quite apart from profits—which, after all, did not appeal to them, as they were controlled by Parliament on this point—they were taking their part in a national industry for the national welfare in developing the use of gas. He hoped the scheme would shortly be available, because during the past few years they had had to neglect this side of their industry. He was only now starting a scheme for recording apparatus in consumers' premises. The first idea of this was for the use of the permanent staff of inspectors. The time had gone when they could limit their efforts to the mere inspection of meters. It was useless to talk of developing the use of domestic appliances in particular unless they systematically examined, inspected, and advised consumers in their use. It was not beyond the bounds of possibility to attach such a system to that of an organized and systematic canvass. He suggested that some of the larger undertakings which had an opening for the employment of numbers of specialized men, canvassing being one, should adopt a system of training a larger number of men than they saw an opening for when trained, and by this means offering to smaller undertakings, who had not the facilities for complete training, trained officials to join their staffs. The bulk of the undertakings were so small as not to give an opening for a sufficiently wide experience. The larger gas undertakings could afford these faeilities, and could give very valuable assistance to the industry as a whole by encouraging those they had trained to accept positions in the smaller undertakings.

The resolution was cordially passed.

Hospitality Acknowledged.

Mr. Goodenough proposed thanks to the Chairman and Directors and to Mr. Halliwell for their hospitality and their efforts to make the conference a success; and the thanks were heartily accorded.

The Chairman, in reply, said that a new spirit had been infused into the Bristol Gas Company; and he believed they would make very rapid strides, in educating the Bristol public and inducing them to fit up their houses with gas, not only for lighting but for heating, baths, cooking, and everything else.

Heating and Ventilation and the Housing Problem.

In the evening, the Lord Mayor and Lady Mayoress gave a reception at the Museum and Art Gallery. Lord Moulton was to have presided at the lecture by Prof. Leonard Hill; but his absence was accounted for by the following telegram:

> "Urgent Government business to-day makes it impossible for me to reach Bristol in time for to-night's meeting. Please present my sincere apologies to the Lord Mayor and to Prof. Leonard Hill. I much regret my absence from your meeting, with the objects of which I am in the fullest sympathy."

The Lord Mayor presided, and, in introducing Prof. Hill, said that there never was a time in the history of our country when questions affecting the health, welfare, and comfort of the people demanded, and received, so much consideration. He hoped it would find its effect in a little time in marked improvements in the dwellings of the people, making for better health and the building-up of their physique. It was interesting to have this gathering in Bristol, which was a pioneer in the gas industry, as in many other things that made for the welfare of the country, the advancement of science, and the expansion of industry. They were proud of their traditions. But they could not live on traditions, and must keep abreast of the times, which they were striving to do. (Applause.)

Extracts from Prof. Hill's lecture will be found on p. 500.

Votes of Thanks.

At the close of the lecture, which was listened to with great attention and interest, Mr. Goodenough proposed, and Mr. Rowe seconded, a vote of thanks to Prof. Hill, which was carried by acclamation.

The Lord Mayor and the Lady Mayoress were very cordially thanked for their hospitality, on the proposition of Mr. J. H. Howell seconded by Alderman George E. Davies; and the large company then adjourned to another room, where refreshments were partaken of as a pleasant wind-up to a thoroughly enjoyable and profitable day.

NEW ZEALAND BROWN COALS.

It is stated by the "Board of Trade Journal" that the Board of Science and Arts have published a "Bulletin" dealing with investigations into New Zealand brown coals. There are large deposits of brown coals in certain regions of the Dominion, especially in the southern portion of South Island; but deposits of bituminous coals are limited in extent. The investigations were directed towards: (*a*) The use of New Zealand brown coals in gas producing; and (*b*) their low-temperature distillation.

With regard to the use of brown coals in gas-producers, which is already general, important improvements are pointed out—particularly in the direction of more regular feeding of the fuel. In the distillation of the coals, a return of 4 to 8 p.ct. of tar was found as a result of low-temperature distillation. This was redistilled into light oil, middle oil, heavy oil, and pitch, and again into seven fractions in the course of further purification.

The brown coal tars differ from those derived from bituminous coals in being lighter than water, instead of heavier. The resultant coke is distinct from that obtained in gas manufacture, as it is not subjected to so high a temperature, and it still contains comparatively large quantities of hydrocarbons. This characteristic, it is stated, should produce freer burning, and thus render it more useful as a fuel for domestic and other purposes. For these reasons, it would not be so useful for electro-chemical purposes, for which, in any case, the high proportion of ash would reduce its value.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Income-Tax Assessments.

SIR,—As you will be aware, the allowance of one-sixth of the annual value, made to commercial undertakings, does not at present extend to the gas industry.

My company has, however, been pressing the question; and an intimation has just been received that, as the result of our negotiations and correspondence, a clause is to be inserted in the next Finance Bill authorizing the allowance.

It seems to me that as the industry has lost the benefit of the concession for one year, having regard to the wording of the original clause, it is extremely desirable that the promised clause should be carefully considered, in order that the undisputed and overdue claims of the gas industry may be safeguarded.

J. E. LISTER COOPER.

Yeadon Gas Company, May 22, 1919.

Fuel Research Board's Report.

SIR,—I have been expecting to see some further comments in your pages upon the suggestions contained in the above-named report; but as they have not so far been forthcoming, I venture to send you the following observations.

In the first place, I am sure we all agree with you in cordial appreciation of the friendly tone of the report, and the evident desire of the Committee to assist the gas industry. But there are one or two directions in which precedent has unfortunately cast its blighting influence upon these desirable intentions. As the Committee recognize in some of their suggestions, the need of the industry is freedom, if the greatest benefit to the community is to be secured. In the composition and calorific value of the gas recommended for adoption, the Committee's suggestions are excellent; but in the matter of inerts and pressure, the recommendations are too stringent. The recommendations of the Committee are intended for universal application; but, while they might be acceptable in the case of some undertakings, they would be disastrous in others. One can never understand why the gas industry should be handicapped with restrictions, which so greatly hamper its usefulness, while other public utility services—viz., electricity, water, and sanitation—have comparative immunity from them. What we all want is freedom. We have to sell our productions; and if the goods we offer do not satisfy customers we lose our business. This incentive is found sufficient in all other industries. Why not in ours?

The point I am most concerned about is pressure, which the report recommends should be not less than 20-10ths at the outlet of the consumers' meters. In a flat residential district, with a modern distribution system, this may be quite desirable; but in a manufacturing locality, with mains which the consumption has outgrown and which is undermined with colliery workings, it would be almost impossible. Take our case for example. We work with never less than 20-10ths at the gas-works. Nearly four miles away is a colliery district, 80 ft. below the level of our works, in which the ground is always subsiding. To mitigate the evil of broken mains and drawn joints, we recently took out all the cast-iron mains and replaced them with steel, with socket joints 8 in. long. But these joints are continually giving way. Now if 20-10ths at the outlet of the consumers' meters becomes law, this means 21-10ths at the inlet of the meters at the furthest and lowest house in the district, with its liability to leaking joints. Other parts of this colliery district not far away are 300 ft. higher; and as ours is an old distributing plant the consumption pulls the pressure down considerably when the peak load is on. So to give 20-10ths at the outlet of the consumers' meters at our furthest point and at the lowest level (which happens to be undermined with colliery workings) such an excessive pressure would have to be given at the works as to blow the water out of the wet meters and other water-sealed apparatus, and so cause grave risks of explosions in consumer's houses, in addition to the great increase in leakage, with consequent higher price of gas.

I think, therefore, before this recommendation is acted upon, the undertakings prejudicially affected should have the opportunity of putting their case before the Board of Trade.

H. TOWNSEND.

Wakefield, May 22, 1919.

A Gas Film for Cinemas.

SIR,—In your issue of May 13, I notice a suggestion from Mr. F. G. Thomas that a film should be produced showing the important results obtained by the carbonization of coal.

You may be interested to learn that the Automobile Association and Motor Union have had in hand the preparation of such a film for a considerable time; and it is hoped that it will shortly be ready for public exhibition.

The recovery of all bye-products is of such enormous importance to the community as a whole—epecially in view of the world-shortage of motor spirit—that it is hoped the film in question will be of very general interest.

ROBERT H. MONTGOMERY, Captain.
Fuel Department, Automobile Association and Motor Union.

Fanum House, Whitcomb Street, W.C., May 19, 1919.

Salaries of Gas Managers.

SIR,—With reference to the filling of vacant posts and the salaries offered in the gas industry in particular, I should also like to draw your attention to the terms of appintment which are being set out in connection with the post at Chesterfield. From the enclosed you will see that this official, if he accepts all the conditions set forth, will be nothing more than a glorified works foreman.

The Secretary and Accountant is to arrange the sale of all residuals, and the purchase of all stocks and stores, and although the gas engineer has to be responsible for the distribution of gas, the water engineer has charge of the laying of mains and services up to the consumer's meter. But the poor gas engineer has to be responsible for the estimates for carrying out such works. All the clerks, collectors, inspectors, and storekeepers are also under the secretary and accountant, and have to be borrowed from him. Even the assistant draughtsman has to be borrowed from the water engineer, for work to be carried out for the gas engineer, which apparently is under the water engineer's direction. It appears from the study of these particulars that the unfortunate gentleman who accepts this appointment will only be there to be kicked by everybody.

This is another glaring instance of the strong need for organization to defend and improve the status of professional men connected with the gas industry.

ENGINEER.

May 23, 1919.

[ENCLOSURE.]

Terms of Appointment of Gas Engineer and Manager to the Chesterfield Gas and Water Board.

1. Candidates must be fully qualified to act as engineer and manager of a modern gas-works; and a candidate having a thorough knowledge of the chemistry appertaining to gas manufacture will be preferred.

2. The commencing salary is £600 per annum, payable quarterly. No allowance will be made in respect of house, coal, gas, or water consumed. There is no house provided for the manager on the works.

3. The candidate appointed will be entitled to fourteen days' holiday each year.

4. The present officials of the Gas and Water Board consist of a secretary and accountant, a water engineer, and a works manager in the gas department. The last-named official will be under the direction of the newly appointed gas engineer and manager.

5. The secretary and accountant—having regard to his long experience in the sale of gas residuals—will, subject to the direction of the Board, be responsible for finding the best markets and accepting prices for such residuals. Subject to this qualification, the candidate appointed will, under the direction of the Board, have full control of the manufacture and distribution of gas for all purposes, and the general development of the gas undertaking.

6. The water engineer will carry out the laying and re-laying of such gas-mains and services up to the consumer's meter as may from time to time be required, and shall have the same responsibility in regard thereto as would appertain to a contractor; and the relationship of principal and contractor shall govern any question arising as to the sufficiency of the estimates of the gas engineer for the carrying out of such works.

7. Any constructural alterations required to such shops, stores, stock-yards, and other buildings at the gas-works, which are at present joint establishments of the gas and water departments shall, as to necessity, design, &c., be agreed upon mutually by the gas and water engineers; but the carrying out of any such alterations shall be under the direction of the gas engineer.

8. All applications for gas and water, and all purchases and sales of stocks and stores shall be transacted through the secretary and accountant, in consultation with the respective engineers. But the quantity and quality of manufactured stores shall, as to the gas department, be in the discretion of the gas engineer, and as to the water department, in the discretion of the water engineer. Written requisitions for goods required should be sent to the secretary and accountant by the respective engineers.

9. STAFF.—(*a*) All the clerks, collectors, prepayment meter collectors, or meter inspectors and store-keepers shall be under the control and be responsible to the secretary and accountant. Any clerical assistance required by the gas engineer or the water engineer shall be supplied from the secretary's staff; and whilst so employed shall be under the instructions of the particular engineer. (*b*) All men engaged on the works of the gas department exclusively in the manufacture of gas (including yard men), together with the sales manager, meter repairer, and gas-fitter, shall be under the control of, and responsible to, the gas engineer, provided that the mechanics, blacksmiths, and joiners shall be available under the gas engineer's direction for any work required to be done by the water engineer. (*c*) The water inspectors, reservoir keepers, assistant draughtsman, plumbers, and mainlayers shall be responsible to, and under the control of, the water engineer, provided that the assistant draughtsman shall be available under the water engineer's direction for any work which is required to be done by the gas engineer.

The New "Eagle" Gas-Range.

SIR,—In your issue of April 29, I very carefully read about a new gas-cooker which Messrs. John Wright & Co. have invented, and for which they claim that it has no equal. As you know, I have made it my business to try the various types of stoves for many years past; and my experience of claims made by different gas-stove makers has been that the cookers, when tested by really practical methods, have sometimes fallen very short of what it was claimed they could do in the way of giving satisfaction to the users.

I communicated with Messrs. Wright & Co., and asked whether they were prepared to submit their new gas cooker to a very severe test; and they agreed. Accordingly, I visited their works, and had one of their new "Eagle" gas ranges, size No. 22, put entirely at my disposal to do what I liked with. Here are some facts. I roasted a joint of meat, baked some bread, tea cakes, currant cake and pastries, and roasted some potatoes, all at one time, in this gas-oven.

It is the first gas-oven I have ever used which is a cooker all the way from the bottom to the top; and the cooker does its work with a greater economy of gas and of labour than I have found with any other cooker.

I think these facts ought to be made known in the interests of users of gas-cookers and of gas authorities.

R. GAMBLE MARKS.

54, Zetland Street, Southport, May 7, 1919.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Examiners certified that the further Standing Orders applicable to the Dover Gas Bill had been complied with.

The Newark Gas Bill and the Sheringham Gas and Water Bill were reported with amendments.

In connection with the Pembroke Gas Bill, a petition of the Gas Company for additional provision was read and referred to the Examiners.

It was agreed to dispense with the Standing Orders not complied with in respect of the petition for the Swinton and Mexborough Gas Board Bill.

The Huddersfield Corporation Gas Bill was read the third time, passed, and sent to the Commons.

The Stocksbridge Gas Bill was brought from the Commons, read the first time, and referred to the Examiners.

HOUSE OF COMMONS.

Progress of Bills.

The Hartlepool Gas and Water Bill was read a second time, and committed.

The Midland Railway Company have petitioned to be heard against the Elstree and Boreham Wood Gas Order.

The Cannock, Hednesford, and District Gas Company, Ltd., have petitioned to be heard against the Walsall Corporation Bill.

The Gas and Water Provisional Orders Bill was read a second time, and committed.

It was agreed that the Standing Orders should be dispensed with, and the Dover Gas Bill be permitted to proceed.

The Stocksbridge Gas Bill was read the third time, and passed.

The Huddersfield Corporation Gas Bill was read the first time, and referred to the Examiners.

The Swinton and Mexborough Gas Board Bill was read a second time, and committed.

The Ammanford Gas Company have applied for leave to deposit a petition for a Bill.

Petitions against the Swinton and Mexborough Gas Board Bill have been deposited by the Wath, Bolton, and Thurnscoe Gas Board and the Wath-upon-Dearne Urban District Council.

Coal Supplies.

Mr. MANVILLE asked the President of the Board of Trade whether the supply of coal to industry and for domestic use would be further reduced after the end of June. If so, could he state whether this reduction, which would so adversely affect the industry and prosperity of the country, was due to shorter hours of working in the coal mines, leading to smaller average production by the miners, or whether it was caused by smaller average production of the coal miners for reasons unconnected with the shortening of the hours of working.

Sir AUCKLAND GEDDES, the Minister of Reconstruction, replied that he feared that it would be necessary either to reduce the supply of coal to industry and for domestic use, or to limit even more strictly than at present the amount allowed to be exported. It was not possible to give a more definite answer until they knew the effect of the reduced hours of working upon output. In reply to the last part of the question, he regretted to have to say that the output of coal per person employed continued to show a decrease without any shortening of the hours of working.

Burnley's Unique Lamp-Rate.

Mr. R. C. Maxwell, on behalf of the Local Government Board, conducted an inquiry at Burnley last week into the Corporation's application to amend a Local Act to increase the lamp-rate from 6d. to 1s. in the pound. Whereas in the year preceding the war the lighting, &c., of the street-lamps cost £3353 and gas at 1s. 8d. a 1000 c.ft. another £5222, the cost last year for lighting 25 p.ct. only of the lamps was £2710; and had the same amount of gas been consumed at 3s. 6d. the total cost would have been £17,650, or a rate of nearly 11d. The future of the gas undertaking, stated Mr. J. P. Leather (the Gas Engineer), was very uncertain. It was difficult to estimate expenditure and possible profits, because even yet they did not know what wages and the price of coal and other materials might be. There did not seem to be any prospect of a reduction. The estimate of 3s. 6d. per 1000 c.ft. for gas manufacture was rather too low than too high. The lamp-rate was levied all over the borough; and the lamps were not more than a hundred yards apart, even in some of the country lanes. The Inspector stated that the fact that the Burnley Corporation were limited to a certain sum for street lighting was almost unique. In other towns they had general powers to take it out of the district rate, and the only limitation was what was reasonable. There was no opposition; and the Inspector remarked that the application seemed a very straightforward one. The Corporation were limited by a Local Act which was passed before modern times; and in this Act there were limitations which the smallest corporation in the land had not to suffer. It seemed entirely a technical difficulty.

Price of Gas Increased at Belfast.—The Belfast Corporation Gas Committee have decided upon an increase of 5d. per 1000 c.ft. all round, which raises the existing price of 3s. 9d. to 4s. 2d. With the discount of 20 p.ct. this represents an average net price of 3s. 4d. per 1000 c.ft.

MISCELLANEOUS NEWS.

HEATING AND VENTILATION IN RELATION TO THE HOUSING PROBLEM.

By Prof. LEONARD E. HILL, M.B., F.R.S.

[Extracts from a Lecture delivered at the Blackpool Conference of the "B.C.G.A.," on May 20.]

After dealing with more general topics—such as the importance of cheap coal, the smoke nuisance and its effects, the evils of crowded indoor life, the working of the "Kata Thermometer," organic heat production in close industrial atmospheres, some principles of ventilation—the lecturer proceeded:

The Heating Question and Coal Economy.

I now turn to the difficult question of heating. The ideal conditions are afforded by radiant heat, warm ground, and abundant cool, moving air. How are we to secure healthy conditions, and at the same time save coal and prevent the pollution of the atmosphere?

Of the coal used, it is estimated that mines and factories take 80 million tons per annum; iron and steel, &c., 32; bricks, ceramics, &c., 6; railways and coasting steamers, 17; gas-works, 19; domestic purposes, 35 to 40. In 1907, 97 p.ct. of the power used was derived from coal.

Prof. W. A. Bone estimates that at present only 4 p.ct. of the thermal energy of the coal is made use of; that 96 p.ct. is wasted; and that 5 lbs. of coal per B.H.P. are expended. The actual coal reserves available in this country are given as six hundred times the present yearly output. The important question, however, is how long can we continue to get coal at a cost which does not place us internationally at a disadvantage? The present coal consumption used economically would, says Prof. Bone, produce at least three times the present amount of power. What a frightful waste of labour and wealth this statement implies!

Government Schemes.

Powerful arguments are now being put forward against individualistic power stations, and in support of co-operative methods. The Government Coal Conservation Committee have recommended that large power stations be erected, and methods perfected for extracting bye-products from coal before using it for the production of electrical power—the two plants to be combined. Power available from surplus gas, and waste heat generated in factories, are to be turned into electrical energy on the spot in local plants which will feed the main distributing systems. There are visions before us, then, of the conversion of coal into electricity at huge central super-stations, and its distribution throughout the land. Cheap electrical power for the supply of heat, light, and power has become part of the Government programme; and the man in the street believes that this project is going to effect a great saving of fuel.

The reduction in the cost of coal-handling involved in house-to-house delivery and general coal distribution is to be enormous. It is estimated that, in place of 5 lbs., only 1½ lbs. of coal will be used per H.P.-hour; and that 100 millions per annum will be saved, apart from the advantages of a cheap and efficient supply of electric power. It is put forward in the Coal Conservation Committee's report that "great advantages and economies would result from the more extended use of electricity in the household for heating, cooking, and cleaning purposes, in the way of labour-saving devices, reduction of smoke, and increased cleanliness."

A Challengeable Claim.

Now, with this last statement, the most eminent authorities disagree. Prof. Bone says: "If I want heat, I am going to use gas; and if power for industrial purposes, electricity." Whether a gas-engine or a steam-turbine is the prime mover is a matter of indifference to him.

Prof. Bone takes coal at 45s. per ton; gas at 4s. 6d. per 1000 c.ft.; and electricity at 1½d. per unit. He says for £1 you could buy 13,350,000 B.Th.U. as coal, or 2,250,000 B.Th.U. as gas; or 550,000 B.Th.U. as electricity. With coal-heating appliances, you would usefully utilize 4 millions; with gas 1,800,000; with electric, 500,000. "Electricity then must be absolutely ruled-out for house heating."

Prof. Bone is of the opinion that "industrial development is now so far advanced that all coals used for the smelting of iron and steel, and for domestic consumption, should be carbonized before use—that is 45 p.ct. of the whole." In 1913, there was carbonized a total of 17 p.ct.

What Other Experts Hold.

Sir Oliver Lodge writes: "Coal should be dealt with chemically by gas engineers in retorts at its source; the gas to be transmitted through pipes to centres of population for the production of easily manageable heat. Electricity should be generated and distributed for power and light. Home industries then can be revived, and with them individuality of work and family life."

According to Sir Dugald Clerk, the only practicable method of coal economy is to carbonize all coal at gas-works, and legislate to prevent the direct burning of coal either for domestic or for manufacturing purposes. Steam-boiler furnaces would then be adapted to consume the coke produced in gas making; and an ample supply of cheap fuel would be available for the use of electrical generation and all other purposes.

Prof. J. W. Cobb says: "The gas-works would only have to take double their present load to fulfil the whole of the domestic supply; while electrical plant would have to be increased tenfold."

Lord Moulton expressed the opinion that, as an economical substitute for the open fire, gas left electricity entirely out of the calculation; and that domestic heating was a great field in which gas had no competitor. "It is a ghastly waste," he continued, "to burn coal

under a boiler, and use four-fifths straight off for the purpose of turning the rest back into heat." Let us consider why this is so.

COMPARATIVE THERMAL EFFICIENCIES OF GASIFICATION AND ELECTRICITY GENERATION.

A Board of Trade unit of electricity represents an amount of energy which, when it is completely converted into heat, yields 3411 B.Th.U. This is as nearly as possible the heat value of ¼ lb. of good coal, as 1 lb. of coal yields 13,000 to 14,000 B.Th.U. To deliver by means of an electric stove to the consumer the heat contained in ¼ lb. of coal, 3½ lbs. of coal would, on the average, be used in the generating station—at the worst stations 5 lbs., at the best 2 lbs. Taking the most optimistic estimate for the future super-station, the 2 lbs. might be reduced to 1½ lbs.

Now let us turn to gas. Taking coal gas of the value of 500 B.Th.U. per cubic foot, there is a net destruction of only just over ⅛ lb. of coal at the gas-works to deliver to the consumer gas containing the heat value of ¼ lb. of coal; and 75 p.ct. of the heat value of this gas is yielded by a gas-fire. I say "net destruction," because although 1 lb. of coal is used to produce this gas, about ⅛ lb. of coke is left over; and this coke has the same fuel value as ⅛ lb. of coal.

THE IMPORTANCE OF THE BYE-PRODUCTS.

Moreover, from every pound of coal carbonized at a gas-works, valuable bye-products are recovered. When coal is burned under boilers to generate power (steam or electrical) or in domestic fireplaces or kitchen grates, these valuable chemical substances are either burnt and left as ashes, or else go up the chimney in the form of tarry vapours and sulphuric acids to cut off the sunlight, damage our buildings, destroy vegetation, make black and hideous our environment, depress our health, and lessen our happiness.

The late Prof. Vivian Lewes made the very interesting estimate that the burning of gas for the same yield of heat in warming a room puts only one-fifteenth of the sulphur into the atmosphere which the burning of coal does; and I am informed by other authorities that the figure might fairly be put at only one-twentieth, or 5 p.ct.

Every ton of coal distilled at the gas-works yields 12,000 to 13,000 c.ft. of gas and about ½ ton of coke, as well as the important bye-products. So much of the coke as is hard and suitable for metallurgical purposes is used for smelting iron; while the remainder is used under boilers for generating steam and warming factories, driving dynamos, &c. Coke has approximately the same thermal efficiency as coal.

As to the bye-products, the tar, after the removal of toluol, benzol, naphthalene, &c., is used for roads, and is of the utmost importance for transport and the avoidance of the dust nuisance. Creosote oil is used in the Navy, in place of coal as a fuel. It is also used for impregnating wood for railway sleepers, telegraph posts, &c. Toluol gives us the famous explosive "T.N.T.," without which the war could not have been won. Benzol is the chief mother-substance of the synthetic dye manufacture, and can replace petrol as a fuel. Naphthalene is a great insecticide. From tar are derived saccharine, antiseptics such as carbolic acid, lysol, &c., and important drugs such as aspirin, sulphonal, and salvarsan. From tar come dope for aeroplane wings, and carbon bisulphide and solvent naphtha used in rubber manufacture. Ammonia and ammonium sulphate are other valuable bye-products. Seven million tons of nitrogen are lost each year in the coal burnt, which ought to go to fertilizers. Ammonia is used in refrigerating plants, and in a host of other ways. Ammonium sulphate, a most important fertilizer, took the place of nitrate of soda during the war.

POWER PRODUCTION AND THE CONSERVATION OF ORIGINAL ENERGY.

To turn to another aspect of the case, the heat equivalent of a H.P. hour is 2564 B.Th.U. One pound of coal yields 13,000 B.Th.U. One-fifth of a pound of coal, then (if there were no loss), would yield one horse power. On the authority of Prof. Bone, with a good gas-engine and a gas-producer plant it takes 1 lb. of coal to produce 1 H.P. With a good reciprocating steam-engine, it takes 2 lbs. With the best type of large steam-turbine, he claims that 1 lb. may be reached. In converting coal into power, then at the maximum we can secure only one-fifth of the energy. At present, he says, we secure only one twenty-fifth. It is necessary therefore to use the coal otherwise, in the most economic way.

According to Prof. Bone, 89 p.ct. of the energy of a ton of coal is secured after carbonization at the gas-works—in the gas 23 p.ct., in the coke 60 p.ct., and in the bye-products (tar, &c.) 6 p.ct. Now if we use the gas for domestic heating—as a modern gas-fire yields 75 p.ct. of the energy of the gas, and the modern gas water-heaters are almost as efficient—we may secure for cooking, water boiling and heating, &c., let us say at a moderate estimate 15 p.ct. of the original energy of the ton of coal. The coke burnt under the best type of boilers yields 13 p.ct., in super-stations perhaps 17 to 20 p.ct., of its energy as power—affording, let us say, at a moderate estimate 8 p.ct. of the original energy of the ton of coal. Suppose from the bye-products we secure the value of 5 p.ct. of the energy value of the ton of coal, the total then is 28 p.ct., against 4 p.ct. now secured according to Prof. Bone, or seven times as much.

THE ONLY ROAD TO ECONOMY.

It is clear which way economy lies. All coal must be carbonized at central stations; the gas delivered through mains for domestic heating and lighting; the coke used for generating electric power and light, or gasified and used for gas-engines and the production of power; and the bye-products used for dye-works, road tarring, fertilizers, &c.

From the figures given us authoritatively, we can say that, taking the annual consumption of coal for domestic purposes as 40 million tons, the present gas-works would effect the same actual work for 30 million tons; the future super gas-works may affect it for 20 million tons; the present electrical generating stations require for the same purpose 120 million tons; and the future super-stations will need 60 million tons (with the total loss of the bye-products if coal be consumed under the boilers).

As to the distribution of gas and electricity, the capital cost of gas-mains and of electric cables is probably much the same. The upkeep of gas-mains is almost nothing, as 48-in. mains have been laid down for fifty years; and there is every reason to think they will last for a very long time. There is no difficulty in delivering gas for long distances from central stations by pipe lines with intermediate pumping stations, and gasholders at each town where the supply is taken.

Sir Robert Hadfield cites figures computing the loss in transmission of high-tension electric current to be 12 p.ct.—*i.e.*, from the dynamo to the low-tension conductors. The loss in transmission of present day gas is 2 to 3 p.ct.

CO-OPERATION OF GAS AND ELECTRICITY UNDERTAKINGS.

Whether there should be a few central power stations or many (as at present) is a matter of convenience and economy in the transport of coal, the distribution of bye-products, &c. But what seems quite certain is that gas and electricity should be generated together, and delivered together to all consumers. Wherever it pays to take a cable for power, it will most certainly pay to take a gas-pipe for heating.

THE FUTURE OF GAS AND COKE.

Cooking and heating of water by gas will, I believe, with the carbonization of all coal, become universal in small houses; while in large establishments a coke-fired boiler will hold its own. The ordinary form of kitchen range—wherein a coal-fire roars away under a few square inches of boiler surface for the purpose of feeding a hot-water supply, unprotected by non-conducting material, and incapable of giving an efficient supply—is absurdly extravagant. Great economy can be effected by standardizing the heating appliances. Heating boilers at present on the market have an efficiency varying from 33 to 65 p.ct. Efficient types must be scheduled, and their use and that of coke as fuel made compulsory.

The heat conserving properties of materials used, and the methods of construction adopted, must be adequately considered. A factory with light roof construction, very large glass surface, and thin walls, cannot be warmed otherwise than by a vast amount of heating surface and fuel. In many factories the amount of heat produced by machinery, lights, furnaces, &c., is so great that adequate cooling (rather than warming) is the trouble; and loss of heat is an advantage.

HOUSING SCHEMES AND THE FUEL QUESTION.

All those now engaged in housing schemes should carefully consider this vital question of national economy, and how far the substitution of gas for coal for heating purposes can be carried into effect in the new houses. The first fire used was wood; then it became coal; now it is gas. In sentiment, it has deteriorated from the ideal of the story books. The smell of wood, the flickering dancing firelight, the vision seen in the dying embers, the clean white ash—these came first. Then followed the foul smell and soot of coal smoke; the pall of smoke; and the dirty ashes. But still visions were seen in the burning caverns, and personal attention was given to the "god of fire." Now we have the gas-fire, monotonous perhaps in form, and evoking as yet no visions, but needing no coaxing attention, receiving no abuse, making no ash, no soot, no foul smoke, involving no trouble or labour, and requiring no sacrifice in the attention paid to this new "god of fire." Sentiment cannot defend colossal waste; custom must conform to the nation's needs. A coal-fire, at the very best, radiates some 25 p.ct. of the heat value of the coal (the average being well below this figure), and ventilates a room at the rate of some 18,000 c.ft. per hour. I may add that none of the salts advertised for sprinkling coal increase its efficiency as claimed. These advertisements are fraudulent; and, just as those of many quack medicines, they should be put down by the law.

THE MODERN GAS-FIRE AND ITS EFFICIENCY.

A modern gas-fire is far more efficient than a coal fire in its heating power. It radiates 50 p.ct. of the thermal energy of the gas, and imparts to the room another 35 p.ct. by conduction and convection. The remaining 25 p.ct. goes up the chimney and assists ventilation. This ventilating power deals with some 10,000 c.ft. of air per hour. In contrast to the coal-fire (in which there is so much waste in lighting-up and letting-out), the gas-fire can be turned-down, started, and stopped by the turning of a tap; and it is clean, smokeless, and labour-saving. To one sitting in front, it almost immediately affords a full measure of radiant heat, and allows one to occupy a hitherto cold room in comfort, and to have the windows open and an abundant supply of cool air. But, remember, there must be direct exposure to the rays; anyone screened from them gets no benefit. Remember, too, that the gas-fire must be scientifically designed and installed—no substitutes, inserted into fireplaces, are really efficient or altogether free from the escape of fumes.

The evolution of the modern gas-fire has taken place along the lines of getting rid of convected heat and the escape of fumes; of keeping the air cool and clean; and of warming the occupants and walls and furniture of a room by radiant heat which passes through the air without warming it.

No gas-fire ought ever to be used except it is connected to a flue leading into the outside atmosphere. The canopy must be so far above the radiants that no excess of air is drawn over them. Once the radiants have attained incandescence, no combustion fumes escape into the room from beneath the canopy.

UNFAIRNESS OF THE RATIONING SCHEME.

The Coal Controller fixed 15,000 c.ft. as the equivalent of gas for a ton of coal. Taking into account the efficiency of the gas-fire, Prof. Bone says that for heating purposes a ton of coal equals 30,000 c.ft. of gas. The Coal Controller was then very unfair to gas consumers, and tended to enhance the waste of coal by putting gas consumers at a disadvantage.

RELATIVE COST, CONVENIENCE, AND HYGIENE OF ROOM HEATING.

The relative cost of heating rooms was given by Mr. C. R. Darling in his Cantor Lectures before the Royal Society of Arts as:

Open coal-fire	1·00
Closed anthracite stove	0·39
Open gas-fire	1·55
Electric radiator	6·50

Future super-stations, by conservation of energy, can make the gas-fire

cheaper than the open coal-fire is now. Count Rumford regarded the air that went up the chimney in excess of what was needed for combustion as a thief, robbing us of heat. My view is that in this climate, where the dampness and the lack of sunshine are so great, we want radiant heat, cool air, and rooms very well ventilated. In America and on the Continent, where in the winter they have greater cold and much sunshine, closed stoves and hot-air systems may be more tolerable. The heated air is far drier, and they have compensations out of doors in the sunshine and bracing cold which we do not get in our foggy climate.

The anthracite stove gives very little trouble, requires no fire-lighting or chimney sweeping, and causes no dust or smell. But it heats the air mainly by convection, and gives off a low measure of radiant heat. So with plenum hot-air systems, and steam and hot-water coils. These all heat the air; and to heat the air is to put the respiratory membrane at a disadvantage, increasing catarrhal disease, and lessening resistance to infection.

A Scheme for Heating Factories by Radiant Heat.

It is, I recognize, very difficult to heat large offices, factories, &c., by radiant energy, and keep cool moving air circulating through them in ample streams, without inducing unpleasant feelings of draught. An enclosed space is wholly different from the vast restless atmosphere outside, with its ceaseless variations; and it is very difficult to imitate the ideal conditions of a May day. When the sun shines, the ground is warm and a cool breeze intermittently blows about our heads. But, though it is feasible, no effort has yet been made to develop radiant heating such as gas would allow—*e.g.*, the placing of separately-controlled small units round the walls, or their suspension from the ceiling at such a height that no one would be screened from the rays unless he cared to screen himself. I want to see a room so heated, and at the same time with abundant cool air circulating through it by inlets all round the walls, and with outlets in the ceiling, with fans driving in and pulling out—fans capable in hot weather of being reversed so that all can drive in, with windows all thrown open.

I want to see the conditions of such a room controlled by a skilled attendant, using as guides in exploring the condition in which each worker is placed, not only the feelings of the workers but also the "Kata" thermometer, the surface temperature of the cheek, and the black fur. I want to see how efficiency and health are increased by such means; and I am very hopeful of good results. If economy and convenience enforce the use of hot water or steam-coils, then I say compensation for the hours spent in the workroom must be found in open-air exercise and in sleeping with windows wide open or in sleeping verandahs. I cannot insist too much on this. Hours require to be shortened, garden cities built, the education of the young in physical exercise enforced, so that compensation is secured for the prevailing indoor conditions. These are the lines of true economy—to save waste and develop power, and with it the health, efficiency, and skill of the workers.

The State's Duty.

The frightful mortality and sickness caused by the present bad housing must be faced by the State with the same boldness as it faced the war; for preventable disease destroys and cripples each year far more people than the war did. From consumption alone there die 60,000 each year; and until we set ourselves fearlessly to tackle these and kindred problems, we cannot claim to be making due use of the goodly heritage won for us by the valour of our soldiers and sailors. As I have tried to show, one prime factor in improvement along these lines will be the more scientific utilization of coal for heating purposes, in such a way as not only to benefit the individual in home or factory, for whom the nature of our climate makes artificial warmth by radiation desirable, but also to derive the fullest possible advantage from the coal mined in this country each year. This dual requirement can best be met (a statement which I have backed with surely unchallengeable authority) by the carbonization of coal in the gas-works of the country—thus ensuring that the maximum of its original heat value is secured from the coal, together with the many valuable bye-products essential to industry and agriculture.

The proposed super-power stations, though it is quite likely they will be able to fulfil a very useful function—particularly if they improve, as they promise to do, the economy of electricity generation—cannot, on national grounds, lay claim to ousting the gas-works as the suppliers of domestic and industrial heat, mainly because the thermal efficiency of electricity generation compares in the highest degree unfavourably with that of gasification. There is, however, ample room for both the gas and electrical industries in the national scheme; but it is essential to our future prosperity and industrial stability that an exact idea should be formed of the possibilities and the limitations of each, and governmental measures taken accordingly.

New Gas-Works for Carlisle.—The Carlisle City Council, at a special meeting last Friday, had under consideration a recommendation of the Gas Committee that new gas-works be erected at Bonstead's Grassing, in the Denton Holme district, at an estimated cost of £250,000. It is calculated that on the present output of over 345 million c.ft. per year, the annual saving with up-to-date plant will be £16,486; while the capital charges for interest and a sinking fund over forty years are put at £14,570 per annum. An amendment that the scheme be postponed for twelve months was defeated by a large majority; and the Committee's proposals were approved.

Sale of New Gas Shares at Coatbridge.—The Coatbridge Gas Company have been under the necessity of increasing their share capital, in consequence of the rise in cost of production; and recently the Directors decided to offer by auction 500 £10 shares, which ordinarily received 7 p.ct. dividend, but owing to the sliding-scale and the high cost of materials and labour were now only being paid £6 6s. p.ct. The sale took place in the Coatbridge Municipal Buildings last Tuesday. The Auctioneer (Mr. A. F. Nicoll) explained that it was anticipated that, by the installation of vertical retorts and the revision of the sliding-scale, the new stock would shortly be earning the full 7 p.ct. The shares were put up at £11 each in batches of ten. The first twenty-one lots fetched £12 1s. per share; later the prices ranged from £11 5s. to £11 18s. per share.

GAS-WORKERS' HOURS.

Arising out of a resolution passed by the Separate Committee of Gas Employers at a meeting held on March 26 last, giving power to a Sub-Committee to negotiate with representatives of the National Federation of General Workers regarding the claim for a 44-hour working week, various meetings took place at the Ministry of Labour, as a result of which the following agreement has been arrived at:

1.—That from and including May 1, 1919, the hours of workmen other than shift workers be reduced to 47 per week, with no reduction in the rate of the nominal weekly pay. Provided that in any re-arrangement of wages under this provision it shall not be necessary to increase the weekly rate of any workman beyond the current trade or district weekly rate.

2.—There shall be one break for meals, except where local customs warrant a departure from this.

3.—Shift workers on eight-hour shifts to continue as at present, but the rate per shift to be increased by 6d. from and including May 1, 1919.

4.—In cases of gas undertakings working twelve-hour shifts, where the shifts are reduced to eight hours, it is on the understanding that approximately the same amount of work is done in eight hours as is now done in twelve. Where the change from twelve-hour to eight-hour shifts has not already been made, the re-arrangement to be completed as quickly as possible, and within six weeks from May 1, 1919. Details in connection with these cases to be left for individual settlement, regard being given to the fact that the necessary conditions will prevent some undertakings from working eight-hour shifts.

5.—In the case of those undertakings which have recently reduced their hours per shift from twelve to eight, those which will do so under this arrangement, and those where an increase in pay has already been given as an equivalent to a reduction of hours, it is understood that the increase in rate per shift will not be payable.

LEEDS GAS-WORKS ACCOUNTS.

The revenue account of the gas undertaking for the year ended March 31 was submitted at a meeting of the Leeds Corporation Gas Committee last Thursday.

The accounts show a gross profit of £133,452, as compared with £127,318 last year. Against the gross profit are placed the following charges: War allowances, £2260; income-tax, £16,727; interest on loans, £49,025; redemption fund charges, £52,027; revenue contributions to capital, £17,365, leaving a deficiency of £3952, as against £2653 for the previous year, and compared with an estimated deficiency for 1918-19 of £17,000. In view of the increased prices of coal and other materials, and of wages, this, together with the report generally, was considered by the Committee to be very satisfactory.

Under the head of manufacture, coal has cost £296,028, as against £223,862 last year. The total income was £703,562, as compared with £581,211—an increase of £122,351. The expenditure was £570,110, as against £453,893—an increase of £116,217. The items under the heading of revenue contributions to capital are: Stoves and fires, £4600; meters and mains, £6698; garage, £694; telpher plant, £913; laboratory and test room, £389; retorts (Meadow Lane), £2043; motor wagons, £2026. The net debt on capital account at March 31 last was £993,184, as against £1,049,318 last year—a decrease of £56,134.

SOME ASPECTS OF THE GAS INDUSTRY.

At a Meeting last Friday of the Newcastle Rotary Club, which is composed exclusively of business men, Mr. A. B. Roxburgh, of the Newcastle-on-Tyne and Gateshead Gas Company, read a paper on "Some Aspects of the Gas Industry."

He traced a ton of coal through its course—when carbonized to make gas, or when burned under a boiler to produce electricity. He said that for every ton of coal put into the retorts, an average yield of gas may be expected of 12,000 c.ft., having a heating value of 500 B.Th.U. per c.ft., a total of 6,000,000 B.Th.U., or a percentage of over 20. There is also available for use about 10 cwt. of coke, of a thermal value of over 12,000 B.Th.U. per lb., or for the half ton 13,440,000 B.Th.U. or 48 p.ct. To this may be added 10 gallons of tar, of a heating value of over 15,000 B.Th.U. per lb., or a total of 1,500,000 B.Th.U., or over 5 p.ct. of the total heat in the coal. Add these percentages together, 20 for gas, 48 for coke, 5 for tar, and we get a total yield of 73 p.ct.; while there is left for agricultural or horticultural purposes approximately 20 lbs. of sulphate of ammonia. The exact yields depend, of course, upon the quality of coal, and the particular method of distillation. The figures are in no way exaggerated—quite the reverse, for they are often exceeded in practice, and take no account whatever of what the future has in store. Makes of 16,000 c.ft. and over per ton of coal carbonized are quite common; but, of course, the yield of coke is rather less. The relative position of the figures can be varied, to suit the needs of the district; but it is safe always to assume that in any reasonable up-to-date gas-works a yield can be obtained of 70 to 75 p.ct. in heat units of the heat latent in the coal at the commencement of operations. The necessity for such a variation depends upon the demand for coke, either for home use or export. The bigger the demand for coke, the more it pays to restrict the yield of gas; whereas, if it is difficult to dispose of the coke, the yield of gas can be increased by 100 p.ct. over the figures given.

Now as to electricity. In order not to make the comparison appear too absurd, a start may be made with theoretical figures. A unit of electricity—providing it can all be turned into heat, without any loss in the transformation—would yield 3430 B.Th.U. The theoretical amount of coal, according to the very latest propositions of super-power stations, necessary to generate a unit of electricity is 1½ lbs. Therefore, taking the figure already given of 13,000 B.Th.U. of latent heat

per pound of coal, it takes 19,500 B.Th.U. in the form of coal to produce a unit of electricity, which transformed to heat yields 3430 B.Th.U., or an efficiency of 17 p.ct. This efficiency is purely a theoretical one. Taking the average over the United Kingdom on the present basis the consumption of coal per unit generated is over 3½ lbs., or an efficiency of less than 8 p.ct. Even at these figures, it must not be assumed that there may be no uses for electricity as a heating agent; but economically they are confined to the very high-temperature furnace—say, over 1700° C.—and the furnace requiring the absolutely reducing atmosphere.

It may, of course, be advanced that, by means of waste-heat stations, much electricity may be generated without adding to the consumption of fuel at all. There is only a modicum of basic truth in the assertion. How much better to distribute the gas for use at the point where heat is desired, as is done in Middlesbrough. There, for five years, no coal at all has been used by the Corporation in providing a gas supply; the whole having been purchased from a firm working coke-ovens, and distributed to the consumers. Here 1000 c.ft. of gas distributed in this way will have a heating value of 500,000 B.Th.U. Presuming the efficiency of this gas when used as a heating agent is only 60, we get the actual total heat used of 300,000 B.Th.U. This is when used for boiling water, for gas-fires, general cooking operations, furnaces, &c., in the home or factory in the ordinary way. If this same amount of gas had been used in gas-engines (which have a considerably higher thermal efficiency than steam) to generate electricity, the total yield would not have been more than 30 electrical units—or 103,000 B.Th.U. at the switchboard. When distributed to the consumers, allowing 10 p.ct. loss in distribution, the actual heat available would be (say) 93,000 B.Th.U., assuming the current to have 100 p.ct. efficiency—an impossible figure. If the same 1000 c.ft. of gas were used in a steam-boiler, the amount of electricity available for distribution could not exceed 20 electrical units, or 18 units available on distribution, equivalent to (say) 52,000 B.Th.U.

Mr. Roxburgh, having answered several questions, was heartily thanked for his paper.

Gas-Works Extensions for Maryport.—The Maryport Urban District Council has approved proposals of the Gas Committee to extend the gas-producing capacity of their works at a cost of £2100, which will be borrowed for twenty years. Two beds of regenerative retorts will take the place of direct-fired retorts, which will be demolished. The works are at present capable of producing 280,000 c.ft. of gas daily—from three settings of regenerative retorts with an output of 220,000 c.ft., and two settings of semi-direct fired retorts making 60,000 c.ft. Last winter, despite the restrictions, the output reached 260,000 c.ft. The removal of the restrictions and the increasing demands of Flimby (an adjacent village) make the daily margin of 20,000 c.ft. inadequate. Two new settings of regenerative retorts will make five in all, capable of producing 340,000 c.ft. per day.

BOTHWELL AND UDDINGSTON GAS COMPANY.

Working Results.

The Directors of the Company report, for the year ended April 30, an amount at credit of profit and loss account (including a balance of £1154 from last year's account), after payment of interest on debentures and income-tax, of £4059, out of which they recommend dividends at the rate of 12½ p.ct. per annum (less income-tax) on the original capital, and at the rate of 8¾ p.ct. per annum (less income-tax) on the additional capital, leaving £1457 to be carried forward.

The following are the carbonizing results achieved during the past year by Mr. Lawrence Hislop (the Engineer and Manager), together with the corresponding figures for the preceding twelve months.

	Year ended April 30. 1919.	1918.
Gas made	127,800,000 c.ft.	126,750,000 c.ft.
Gas sold	121,800,000 ,,	122,201,000 ,,
Gas made per ton of coal carbonized	23,580 ,,	15,400 ,,
Gas sold per ton of coal carbonized	22,472 ,,	14,840 ,,
Coke sold per ton of coal carbonized (not including breeze, &c., used in boilers)	7·83 cwt.	9·22 cwt.
Tar sold per ton of coal carbonized	21·6 galls.	19·46 galls.
Sulphate of ammonia sold per ton of coal carbonized	40·68 lbs.	42·19 lbs.
Crude benzol sold per ton of coal carbonized	1·43 galls.	2·19 galls.

Coal Peat and Oil, Ltd.—Presiding at the statutory meeting of the Company last Friday, the Managing-Director (Mr. J. W. Leadbeater) said they were informed that they held a master patent for the products they were making from peat. The Company had works at Earlstown (Lancs.); and the gas given off in the first carbonizing for making smokeless fuel, they had arranged to sell to the local Corporation. In this process, proximity to gas-works put them in a better position for making profit than works situated remote from gas-works altogether, which could not sell their gas. At Earlstown, they had every appliance and facility for doing good business. They would manufacture both fuel and their decolorizer there. The gas produced would pass through a meter into the Corporation holders, and would be paid for on this record. Hitherto during the experimental stage they had been losing this gas, and had not been getting as rich a bye-product as was now being recovered. The idea of purchasing a colliery had been abandoned. Having decided to concentrate the works in Lancashire, they were in a position to buy suitable coal on satisfactory terms.

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BRIGHOUSE GAS-WORKS REPORT.

Reporting to the Brighouse Corporation Gas Committee on the past twelve months' working, Mr. H. Davies, the Engineer and Manager, says the output of gas shows a decrease of 5,685,000 c.ft., or 3·72 p.ct., while the gas sold decreased by 4,271,100 c.ft. only, or 2·79 p.ct. The leakage account was consequently reduced by 1,426,900 c.ft., and now stands at 6·34 p.ct., compared with 7·03 p.ct. in 1918, and 7·92 p.ct. in 1917. Slot-meters show a marked advance in gas consumption of 2,820,000 c.ft.; and the average annual consumption per meter is now 14,106 c.ft. The income from this source was more than double that of 1910, whereas the quantity of gas given for the penny is the same—namely, 26 c.ft.

The average make of gas per ton was 11,626 c.ft., and the gas sold or registered by consumers' meters 10,785 c.ft. per ton of coal, which constitute records in the history of the undertaking. Probably never have the works previously had to carbonize such an inferior class of fuel. The carbonizing plant is not designed for securing the high yields of gas per ton which are obtained at many other works; but the total yields of gas, tar, coke, and ammonia per ton of coal will, when worked out upon a money basis, quite equal, if not excel, many of the more modern undertakings. The residuals yielded 83·33 p.ct. of the total cost of the coal. The cost of coal shows an average increase over last year of 3s. per ton, part of which has been borne by residuals, and part by an increase in the price of gas of 3d. per 1000 c.ft. to ordinary consumers and a rental charge to slot consumers of 1s. quarterly.

The wages accounts amounted to £7635 during the year, as compared with £4342 in the year ended March, 1914. The average price received per 1000 c.ft. of gas sold was 3s. 1·41d. Of this sum, gas cost 1s. 4·20d., distribution 1·85d., rates and income-tax 6·70d., rents, insurance, accountancy, &c., 2·14d., interest and sinking fund 8·24d.—leaving a net profit of 2·28d. per 1000 c.ft. of gas sold.

Mr. E. W. Attlee, a Director of the Dorking Gas Company, has been elected Chairman of the Dorking Urban District Council.

The Colne Corporation gas undertaking made a profit on the past year's operations of £1122, an increase on the estimate of £122.

The South Shields Gas Company announce that the price of gas throughout their area of supply will be reduced by 4d. per 1000 c.ft. from the date of the meter-readings for present quarter.

Under the title of "Bale and Hardy, Ltd.," a company was registered on the 14th inst., with a capital of £20,000, divided into 8000 preference 7 p.ct. shares of £1 each, 10,500 ordinary 10 p.ct. shares of £1 each, and 30,000 deferred shares of 1s. each.

The Port-Glasgow Town Council have placed an order with Messrs. R. Laidlaw and Sons, of the Barrowfield Iron-Works, Glasgow, for a 500,000 c.ft. spiral-guided gasholder, for the new works being built at Fyfe Park, Port-Glasgow.

INDUSTRY AND HIGHER EDUCATION.

A Meeting was held last Tuesday between representatives of the Universities and Colleges and of the Federation of British Industries.

Sir Richard Vassar-Smith, Bart., presided over the gathering, and in his introductory remarks stated that the meeting had been called to consider the setting-up of an organization which might act as a Clearing House between Universities and the industries of the country. It was desired to make some arrangements by which young men leaving the Universities would have the opportunity of passing into productive work, which would give full scope to their abilities and education. Such an organization should enable the man of real merit to obtain a post which would allow him to use his abilities to the fullest extent. Personally, he felt there was need of such an organization, as in the future it would be more imperative than ever that each man, in whatever grade, should be working efficiently. There was a need in industry for a supply (and the maintenance of that supply), of the best intelligences of the country. It was in order to discuss this question that the meeting had been called.

Mr. H. A. Roberts (Cambridge University) stated that the suggestion was one which would meet with approval by all interested in national wellbeing. There were difficulties in setting up such an organization; and it might be advisable in the first case to limit the activities, until further experience had been gained.

Prof. Ferrier (Bristol University) pointed out that there had been no difficulties in placing the really first-class men; but men of the second class certainly needed assistance. As a rough estimate, he would say that 5 p.ct. of the first-class University men would be required for research purposes.

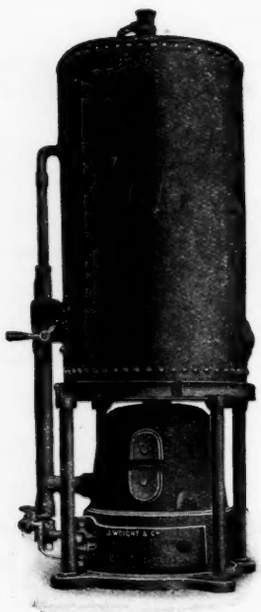
Prof. Baker (Imperial College of Science and Art) stated that he was in full agreement with the last speaker. The real difficulty was in fixing the second-grade students, though there must really be a demand for them. In the Chemical Industry, for instance, there was routine work which would be more ably carried out by the trained man. In most cases, at present, this was done by the ordinary worker.

Prof. Lea (Birmingham University) hoped the scheme would include all grades of men. Industry needed all grades; and education could never hope to produce men of one grade only.

After further discussion, it was decided that another meeting should be held to thrash out practical points for the setting-up of the scheme.

Following recent advances in the price of local electricity and water, Dewsbury gas rates are to be increased from 3s. 8d. to 4s. per 1000 c.ft. for lighting, and from 2s. 10d. to 3s. 2d. for heating.

The Southend Gas Committee recommend the acceptance of the tender of Messrs. Drakes, Ltd., of Halifax, for the construction in a new retort-house at the Leigh Gas-Works of three complete settings, each for eight retorts, at a cost of £2510, and that of Messrs. Mobberley and Perry, Ltd., of Stourbridge, for the necessary retorts.



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CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *May* 26.

The London tar products market maintains an unaltered tone. The values of the various products are: Pitch not below 65s. net per ton f.o.b. makers' works. Creosote, about 6d.; toluol, 2s. 9d. to 3s.; solvent naphtha, 2s. 6d., all net per gallon *ex* works. No business has been reported in 60's crude carbolic.

Sulphate of ammonia is unaltered.

Tar Products in the Provinces.

May 26.

The average values for gas-works products during the week were: Gas-works coal tar, 35s. 6d. to 40s. 6d. Pitch, East Coast, 56s. to 58s. 6d. per ton f.a.s.; West Coast—Manchester 45s. to 46s.; Liverpool, 46s. to 46s. 6d., Clyde, 52s. 6d. to 55s. nominal. Benzol 90 p.ct., North, 1s. 9d. to 1s. 11d.; crude, 65 p.ct., at 120, 1s. 1d. to 1s. 2d. naked at makers' works; 50-90 p.ct. naked, North, 1s. 9d. to 1s. 10d. Toluol, naked, North, 2s. to 2s. 1d. nominal. Coal tar crude naphtha in bulk North, 7¾d. to 8¼d. Solvent naphtha, naked, North, 1s. 10d. to 2s. 1d. Heavy naphtha, North, 2s. 5d. to 2s. 7d. Creosote, in bulk, North, liquid, 5d. to 5¼d.; salty, 4¼d. to 5d. Heavy oils, in bulk, North, 6d. to 6¼d Carbolic acid, 60 p.ct., unsaleable. Naphthalene, £16 to £19; salts, £5 to £6, bags included. Anthracene "A" quality, 7d. to 7¼d. per minimum 40 p.ct.; "B" quality, 2d. nominal.

FROM A MARKET CORRESPONDENT.

Tar Products.

There is a fairly good demand for the leading products. Pitch is well supported, although there has been no further advance in quotations. Considerable progress has been made in reducing Provincial stocks, and South Wales buyers are now ready to pay prices asked, from which it is assumed that the Coal Controller has decided not to assist them. Rather more inquiries from abroad are being received; and although the freight question remains difficult, it would appear that the autumn trade should once again assume importance. Some shipowners have refused to accept pitch on account of the hot weather; but the shipping season has hardly come to an end yet. Prepared qualities of tar are in keen request; and higher prices are being looked for in crudes. Sales have recently been made at above quoted prices. Solvent naphtha is flat, and makers are experiencing difficulty in maintaining quotations; the main reason being that Government stocks of mackintosh goods are still very heavy. Heavy naphtha is lower. Naphthalenes are very dull, and refined is lower. The present warm weather is a slack time in the fire-lighter industry, and makers are not yet preparing for next season. Crudes consequently are neglected, and in some districts as little as £4 10s. per ton has been accepted. Creosote is steady at late rates. Requirements increase as more tonnage is launched. Practically the entire make is being absorbed in the North. Benzol is a very strong market, and the demand seems to increase in spite of the fall in petrol, which is now available for the motorist at 2s. 10d. per gallon (for No. 3), compared with 2s. 8½d. per gallon for benzol. The difference is trifling; but the fact that benzol sales are still noticeably increasing is proof that it is giving satisfaction as a motor fuel. A point not to be overlooked, however, is the relatively high sulphur limit allowed by the Benzol Association—higher, in fact, than is found in fair-quality petroleum spirits. There are plenty of purifying agents. Consequently, there seems no excuse for such a limit. Sulphur causes trouble in internal combustion engines, and therefore in the interests of the development and extension of the business now springing up among the motoring and aeronautical industries, the quality of benzol supplied should surely form a first consideration. Pure benzol and toluol are firm, and good prices are being paid. There is nothing doing in carbolic acid, and other products are without change.

The range of home quotations is as follows:

Benzol: 90% London 2s. to 2s. 2d., North 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 9½d. North; crude 60-65% 1s. 3½d. to 1s. 5½d.; pure, 2s. 6d. per gallon naked.

Carbolic Acid: Crude 60's unsaleable; crystals 40%, 4½d. per lb. asked.

Crude Tar: London, 42s. to 44s.; Midlands, 38s. to 40s.; North 38s. per ton *ex* works.

Pitch: London, 67s. 6d to 70s. per ton; East Coast, 53s. to 55s. per ton; West Coast, 46s. to 48s., with Manchester 47s. per ton and Glasgow 47s. 6d. per ton; South Wales, 56s. to 58s. per ton.

Solvent Naphtha: London, 2s. to 2s. 1d. Provinces average 2s. per gallon.

Crude Naphtha: Naked, 10d. per gallon.

Heavy Naphtha: 2s. 3d. per gallon.

Naphthalene: Refined, £16 to £18 per ton nominal; crude, £4 10s. to £9, according to quality.

Toluol: Naked, 2s. 1d. to 2s. 3d. per gallon nominal. North 2s.

Creosote: London, 7¾d.; North, 6¾d. to 7d.; heavy oil, 7¾d. per gallon in bulk.

Anthracene: 40-45%, 6d. to 8d. per unit per cwt.

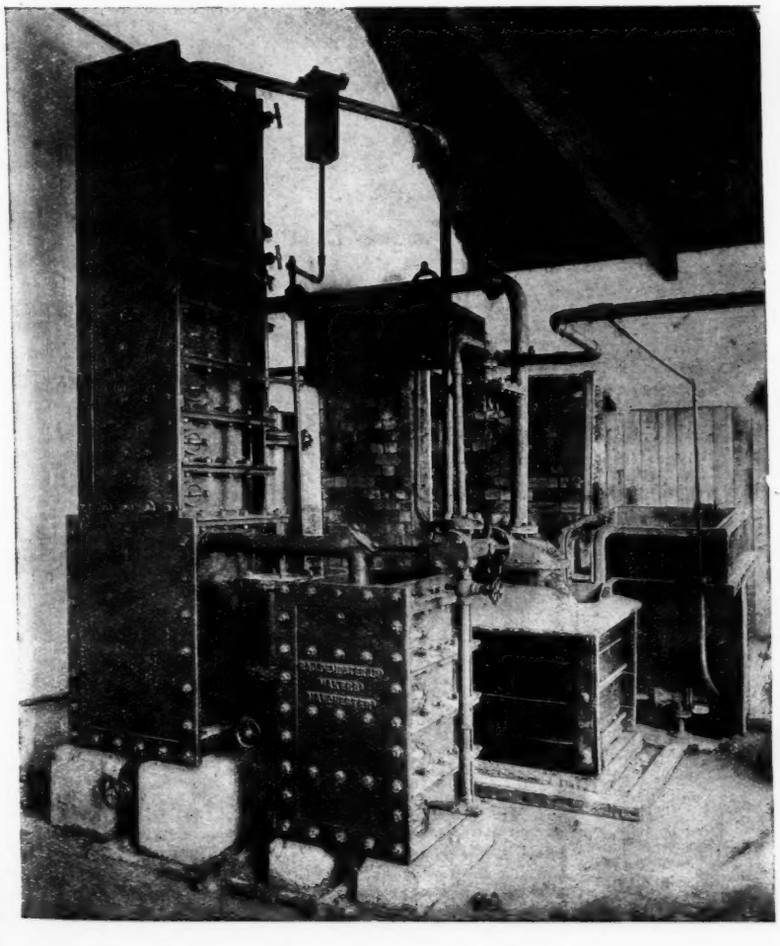
Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 2d. per lb.

Cresylic Acid: 95%, 2s. 9d. to 2s. 10d.; 97-99%, 2s. 11d. to 3s. 3d. *ex* works London, f.o.b. other ports.

Sulphate of Ammonia.

Reports from many centres of distribution are to the effect that retailers are without supplies, and customers are eagerly awaiting



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fresh deliveries. Apart from certain districts in the North, practically all the coke-ovens are in operation; but manufacturers are apparently waiting to see what turns up when official control is removed. A somewhat complicated scheme has been formulated to compensate for the loss of the subsidies. This, in effect, will give makers 35,000 tons at £19 10s. per ton during the dead season, and farmers will have the fertilizer at £17 up to September. Much discussion centres around the export question; and ideas of price are not nearly so optimistic as they were a short time ago. It is realized that foreign markets will need to be carefully tested before a safe limit can be assumed. There are a number of foreign inquiries, which proves that this fertilizer is still needed urgently abroad; but we have more competitors now than before the war. The American position is of particular interest at the moment. Stocks are increasing, and fairly low f.o.b. quotations are being made. An increased trade with the Far East is consequently to be looked for.

French Markets.—Business has been slack since last reports, and buyers are still rather reluctant to place orders. The influence of important Government-owned stocks has been depressing; this being the case foremost in coal-tar intermediates and ammonia compounds.

German Bye-Products Trade.—According to an interesting series of contributions from coke-oven and associated interests, recently published in the "Deutsche Bergwerks Zeitung," it appears that such installations in Germany have suffered considerably during the war owing to their having worked at high pressure. Their chief object was, of course, to produce the maximum amount of ammonia and benzol. The prices for bye-products have not risen very greatly during the war. That of sulphate of ammonia, for instance, now stands in such disproportion to the present cost of a new bye-product plant that the latter would not prove profitable on the basis of existing sale prices for bye-products. Even in the case of existing plants, the position is that coke has become the main product—the bye-products taking a subsidiary place—whereas before and during the war, the reverse was the case.

Cape Town and District Gas Light Company.

At the annual meeting to-morrow, the Directors will report that, after providing interest on debentures and debenture stock, the result of the year's working is a profit of £21,110, which, with the sum of £1559 brought forward, makes a total of £22,669 to the credit of profit and loss account. The sum of £462 has been written off for depreciation of stocks, £2500 has been transferred to reserve and contingency account, £4000 to reserve for plant, &c., renewals account, the sum of £4500 has been paid on account of arrears of dividend on preference shares, and it is proposed to pay a further sum of £9000 on this account—leaving a balance of £2207 to carry forward. The number of gas consumers at Dec. 31, 1918, was 6343, compared with 6547 a year ago—a loss of 204 for the year. The decrease was due to the continued impossibility of obtaining supplies of new meters and parts for the repair of defective meters. The position has now improved; and the large number of applicants for a supply of gas will gradually be dealt with as new meters and other materials arrive. Sales of gas show an increase; but the increased revenue therefrom is offset by the greater cost of manufacture and distribution, and by a reduction in the amount received from the sale of coke, the production of which was lessened by the inferior quality of coal which the Company were compelled to use during the year. Owing to the impossibility of getting new plant erected, it has been found necessary to make greater use of some carbonizing plant of an old type; and this has increased the average cost of their carbonizing. The expected further demands for gas during the present year made it compulsory to reconstruct another portion of the old plant; and this has been done on the best lines possible under existing circumstances. This plant will be in operation in time to meet the heavy demands for gas during the winter season now beginning in Cape Town. The necessity of replacing all old-type manufacturing plant by new plant of modern type is fully recognized; and the reserve of cash in course of accumulation for this purpose will be used as soon as the possibility of obtaining suitable new plant occurs.

Strike at Aberdare.—Owing to a difference between the Gas Company and their employees, there was a shortage of gas at Aberdare last Thursday. The dispute was in connection with a claim for payment during a week's holiday to all grades employed. A short time ago the town suffered from a strike of municipal workers.

Dearer Gas and Electricity at Bury (Lancs.).—The Bury Corporation gas undertaking having experienced a loss of £5671 on last year's working, the Gas Committee have decided to increase the price of gas 7d. per 1000 c.ft., bringing the charge to 4s. 7d. A loss of £1983 is reported on the electricity undertaking; and the price of current is to be increased 30 p.ct.

Automobile Association and the Supply of Benzol.—A representative meeting of motorists and others interested in transport, arranged by the Fuels Department of the Automobile Association at Guildford last Tuesday, unanimously passed a resolution calling upon the Government, in the national interest, to carry out immediately the recommendations of the Fuel Research Board on Gas Standards, providing that all gas companies shall be required to strip the benzol completely from their gases, and to remove the restrictions at present hampering the manufacture of commercial alcohol for motor fuel. General Sir Edmond Elles, Vice-Lieutenant of Surrey, who presided, ascribed the enormous price of petrol to the Government tax, to large and powerful oil combines holding up oil, and to the lack of encouragement on the part of the Government in the home production of motor spirit. Captain Montgomery, the Secretary of the Joint Fuels Committee, spoke of the great potential supplies of commercial alcohol which should be developed, and said that this country could produce 450,000,000 gallons of benzol per annum, if the coal were treated scientifically. Motorists desiring information concerning benzol retailers are invited to communicate with the Fuels Department, A.A. and M.U., Fanum House, Whitcomb Street, London, W.C.

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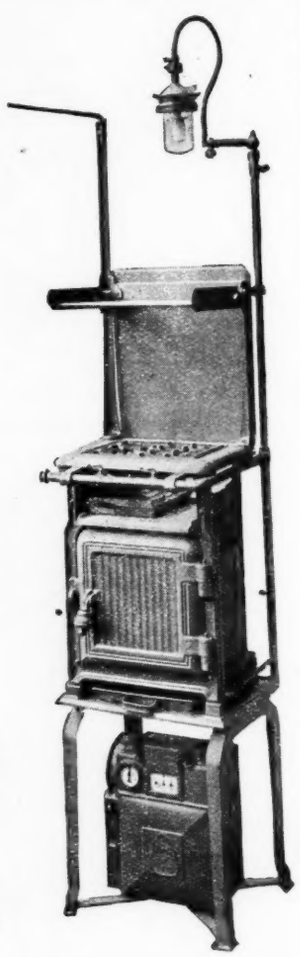

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The Midland Gas-Meter Industry.—The shortage of gas-meters is maintained. Birmingham manufacturers were never busier than they are to-day. Their orders are mostly for the home trade; and they are employed up to their full capacity. Midland firms have promising inquiries from abroad; but these cannot be touched. The Birmingham Gas Department have not restarted the hiring system in relation to stoves and gas-fires.

A Curious Gas Poisoning.—Mrs. Louie Storry, of Moseley, has met with her death under strange circumstances. Her husband stated at the inquest that, returning home on the day of the occurrence, he found the place full of gas. His wife was seated in a chair at a table on which was a little gas-ring, with the rubber tubing broken off at the nozzle. He turned off the gas, threw open the doors and windows, and attempted to carry her into another room; but she was dead. He expressed the opinion that she was about to get a cup of tea for herself, when she had an attack of faintness, and, falling in the chair, snapped off the tubing, which was getting rotten. Death was due to coal-gas poisoning. The Coroner returned a verdict of "Accidental death."

Gas Company's Clerk Convicted of Stealing.—George B. Myers, a wages clerk in the employ of the Harrogate Gas Company, has been sentenced to three months' imprisonment in the second division, for stealing £296, which he obtained from the head office of the Company to take down to the works for payment of wages. He absconded to London, and only returned when the money had all gone.

Ripon without Gas.—The men employed in various municipal departments at Ripon having gone out on strike, the city recently experienced the inconvenience of being without a supply of gas. The trouble commenced in the Highways and Sanitary Departments, where the men applied for an increase of wages; and their demands not being fully met it was decided to strike. The gas stokers, whose application for an increase had been granted, and who, like the other Corporation employees are members of the Municipal Employees' Association, came out in sympathy. Ultimately the strike was settled by the Ripon Corporation deciding to accede to the demands of the men for an increase of 2d. per hour, when they recommenced work; this rise not to be retrospective. Work was resumed last Saturday; but it was not expected that gas would be available before yesterday.

STOCK MARKET REPORT.

BUSINESS on the Stock Exchange was quieter last week, and in many markets there was a distinct recoil from the high level of prices recently obtained. This, however, is but a normal feature; for pendulums swing both ways, and profit-snatching always attends big advances.

With the exception of the 5 p.ct. Loan, Government issues, both Home and Imperial, were lower. Consols could barely touch 56¾ on Friday—a fall of ¼. Home Rails had a uniformly dull week, and Canadians were uncertain. Argentines were in a doubtful mood and closed quite easy. In the Foreign Market, French Loans were depressed by a further heavy fall in the Exchange; but they steadied somewhat before the close.

Business in the Gas Market made still further advance last week in its progress towards recovery of something like the activity of other days, and consummation awaits perhaps only the relaxation of official restrictions. Many issues were dealt in; but, as in the week before, two of them outweighed all the rest. Imperial Continental was very busy every day at firm and close figures, ranging only from 134½ to 137; and the quotation was 1 up. Primitiva was about equally active, especially the preference shares, which changed hands up to 73s.; and the quotation rose ½. Eclipsed by these two meteors, the rest of the list were quiet and devoid of any attractive incident.

Bargains done for cash during the week were as follows: On Monday, Cape Town debenture 64, 64½, Gas Light ordinary 61¼, 61½, 61⅜, 61⅞, 62, Hong Kong 7⅜, Imperial Continental 135, 135½, 135¾, 136, 136¼, 136½, Monte Video 14⅞, Primitiva 35s., ditto preference 60s., 61s. 3d., 62s. 6d., 63s., debenture (1911) 50, South Metropolitan 61½, 62, 62½, Brighton and Hove preference 100½, 101. On Tuesday, Cape Town 4⅝, Commercial 4 p.ct. 62, Gas Light ordinary 61½, 62, Hong Kong 7⅜, Imperial Continental 135, 135½, 135¾, 136, 136¼, 136½, 137, Primitiva preference 60s., 61s. 3d., 62s. 6d., 65s., 67s., 67s. 6d., South Suburban 77, Southampton 67½, Wandsworth "B" 68½, Ryde 5 p.ct. 50, Tottenham preference 83. On Wednesday, Aldershot preference 65, Commercial 4 p.ct. 62, Imperial Continental 135¼, 135½, 136, 136⅜, 136¾, Monte Video 14, Primitiva 35s. 6d., ditto preference 65s., 67s. 6d., 68s. 1½d., 69s. 6d., 70s., 71s., 71s. 3d., 73s., South Metropolitan 61½, 62½, South Suburban 78½, Wandsworth "B" 69½, ditto Wimbledon 68½, Brentwood 10 p.ct. 96, 96½. On Thursday, Alliance and Dublin 50, 50½, Brentford "A" 74, ditto "B" 68, Cape Town preference 7⅝, Commercial 3½ p.ct. 58, 59, Continental Union 48½, Gas Light ordinary 61, 61¼, 61½, 61⅜, Imperial Continental 135, 135½, 136, 136½, 136¾, 137, Monte Video 14⅛, 14¼, Primitiva 36s. 3d., 37s. 6d., ditto preference 67s. 6d., 68s. 9d., 69s. 4½d., 70s., 70s. 7½d., 71s. 3d., South Metropolitan 61½, Southampton 67½, 68, Tuscan debenture 45, Aldershot 5 p.ct. maximum 70. On Friday, Alliance and Dublin 50½, Bombay 6, 6 1/16, Brentford "A" 74, Commercial 4 p.ct. 62½, Gas Light ordinary 61, 61⅜, 62, ditto maximum 55½, ditto preference 71¼, ditto debenture 57, Imperial Continental 134½, 135½, 136½, Monte Video 14, 14¼, Primitiva 36s. 3d., 36s. 8¾d., ditto preference 68s. 9d., 70s., 70s. 7½d., 71s. 3d., San Paulo 7⅜, South Metropolitan 62, Newport cons. 79½, Preston 7 p.ct. 90.

In the Money Market, there was a growing demand closing very firm. The Bank rate is 5 p.ct., as fixed on April 5, 1917.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Shares.	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
182,049	Stk.	Mar. 10	4	4%	Aldershot 4 p.c. Pref.	..	62—67	65
1,651,868	"	April 8	2½	2½%	Alliance & Dublin Ord.	59—64	50—53	50—50½
874,000	"	July 10	4	4%	Do. 4 p.c. Deb.	76—79	61—63	..
280,000	5	April 22	7½	8%	Bombay, Ltd.	5⅞—6⅛	5⅞—6⅛	6—6 1/16
50,000	10	Feb. 26	16	12%	Bourne- 10 p.c.	22—30	20—22	..
888,110	10	"	7	7%	mouth Gas B 7 p.c.	15—15½	10½—11½	..
115,000	10	"	6	6%	and Water Pref. 6 p.c.	13½—14	9½—10	..
159,740	—	—	—	4%	4 p.c. Deb.	..	66—68	..
992,045	Stk.	Feb. 26	14	37/-	Brentford A Consolid.	261—266	74—77	74
734,920	"	"	11	31/8	Do. B New	204—209	68—71	68
55,000	"	"	5	5%	Do. 5 p.c. Pref.	109—111	78—83	..
221,400	"	June 11	4	4%	Do. 4 p.c. Deb.	91—93	65—67	..
217,880	"	Feb. 26	11	7½%	Brighton & Hove Orig.	208—218	137—142	..
244,200	"	"	8	5½%	Do. A Ord. Stk.	154—159	94—99	..
933,500	Stk.	—	5	5%	Bristol 5 p.c. max.	..	..	..
580,000	20	Mar. 26	12½	10%	British	44—45	30½—31½	..
120,000	Stk.	June 26	4	4%	Do. 4 p.c. Deb. Stk.	88—90	64—66	..
245,771	"	"	4	4%	Buenos Aires 4 p.c. Deb.	85—87	60—63	..
100,000	10	—	—	—	CapeTown & Dis., Ltd.	1½—2½	4⅝—5½	4⅝
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4—5	7⅛—8½	7⅛
100,000	Stk.	June 26	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	62—67	64—64½
157,150	"	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	..	..
1,618,280	"	Feb. 12	5/9/4	30/-	Commercial 4 p.c. Stk.	106—108	62—65	62—62½
560,000	"	"	5½	26/3	Do. 3½ p.c. do.	108—105	58—61	58—59
475,000	"	June 11	8	8%	Do. 3 p.c. Deb. Stk.	69½—71½	61—63	..
800,000	"	"	4	—	Continental Union Ltd.	76—79	48—53	48½
200,000	"	"	7	—	Do. 7 p.c. Pref.	115—118	70—75	..
51,600	Stk.	Aug. 29	14½	12½%	Croydon A 10 p.c.	..	155—165	..
278,400	—	"	11½	9½%	Croydon B and C 7 p.c.	..	130—135	..
492,270	Stk.	—	6	6½%	Derby Con. Stk.	128—135	..	..
55,000	"	—	4	4%	Do. Deb. Stk.	102—104	..	..
1,002,180	10	July 29	10	5/0	European, Ltd.	17½—18	12½—13½	..
16,298,975	Stk.	Feb. 10	4/17/4	30/-	Gas 4 p.c. Ord.	98—102	61—63	61—62
2,600,000	"	"	3½	26/8	Light 3½ p.c. max.	76—79	55—57	55½
4,062,285	"	"	4	4%	and 4 p.c. Con. Pref.	96—99	70—72	71½
4,674,850	"	June 11	8	8%	Coke 3 p.c. Con. Deb.	72½—74½	56—58	57
180,000	"	"	10	10%	10 p.c. Bonds	..	..	..
82,500	"	Mar. 12	5	4½%	Hastings & St. L. 5 p.c.	..	59—64	..
258,740	"	—	3½	2½%	Do. 3½ p.c	37—39	44—49	..
70,000	10	April 29	11	7%	Hongkong & China, Ltd.	16½—16½	7—8	7⅞
86,600	Stk.	Sept. 12	9	8½%	Hornsey 7 p.c.	..	115—120	..
181,000	"	Mar. 19	7½	6¾%	Ilford A and C.	151—154	90—95	..
65,780	"	"	6¾	4½%	Do. B	115—118	69—74	..
65,500	"	June 26	4	4%	Do. 4 p.c. Deb.	92—94	62—65	..
4,940,000	"	May 14	9	4½%	Imperial Continental	150—160	133—138	134½—137
1,225,000	"	Feb. 12	8½	5½%	Do. 3½ p.c. Deb. Red.	84—86	72—74	..
255,242	"	Mar. 12	6¾	6¾%	Lea Bridge Ord. 5 p.c.	119—121	90—95	..
2,498,905	"	Feb. 26	10	42/6	Liverpool 5 p.c. Ord. A B	211—218 146—148	..	..
806,088	"	June 26	4	4%	Do 4 p.c. Pr. Deb. Stk.	..	..	..
165,786	"	Feb. 17	7/5/6	32½%	Maidstone 5 p.c.	..	58—63	..
75,000	5	June 11	6	8%	Malta & Mediterranean	4¼—4⅝	3½—3⅞	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99—101	90—97	..
541,920	20	May 26	4	5%	Monte Video, Ltd.	11½—12	14—16	14—14⅞
1,875,892	Stk.	July 29	4½	5½%	Newcastle&Gatsh'dCon.	98½—99½	67—69	..
529,705	"	June 26	5½	5½%	Do. 3½ p.c. Deb.	82—88	57—59	..
55,940	10	Feb. 26	7/14/0	7½	North Middlesex 7 p.c.	14—15	9½—9⅞	..
800,000	Stk.	May 14	8	8%	Oriental, Ltd.	117—122	101—104	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½—7⅞	4⅜—5⅛	..
60,000	50	Feb. 26	18	7½%	Porto Alegre, Island B	178—181	76—81	..
100,000	50	"	12	6¼%	Do. C	118—121	58—63	..
249,980	5	April 29	8	—	Primitiva Ord.	5½—6	1½—2	35/—37/6
499,960	5	June 26	5	—	Do. 5 p.c. Pref.	4⅝—5	3½—3⅝	60/—73/-
521,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91—93	74—76	..
600,000	Stk.	July 31	4	4%	Do. " " 1911	..	50—53	50
346,198	"	June 26	4	4%	River Plate 4 p.c. Deb.	86—87	48—52	..
150,000	10	May 14	6	6/	San Paulo 6 p.c. Pref.	10½—11	7½—8	7⅞
195,000	50	July 1	5	5%	5 p.c. Deb.	44—49	41—43	..
185,000	Stk.	Mar. 12	10	9%	Sheffield A	238—234	80—84	..
209,984	"	"	10	5%	Do. B	232—234	80—84	..
523,500	"	"	10	4½%	Do. C	220—222	71—74	..
133,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	..	..	..
90,000	10	May 28	9	6/-	South African	10½—11½	13—14	..
6,609,896	Stk.	Feb. 10	5/4/0	30/-	South Met. 4 p.c. Ord.	111—115	61—64	61½—62½
250,000	"	July 12	—	5%	Do. Pref.	..	96—98	..
1,895,445	"	July 10	8	8%	Do. 3 p.c. Deb.	72½—74½	54—56	..
234,820	"	Feb. 26	5½	5½%	South Shields Con. Stk.	158—160	99—101	..
963,795	"	"	6	3½%	S'th Suburb'n Ord. 5 p.c.	114—116	76—79	77—78½
197,553	Stk.	June 26	5	5%	Do. 5 p.c. Deb. Stk.	116—118	89—92	..
647,740	"	May 14	7½	8%	Southampton Ord.	99—102	67—69	67½—68
121,275	"	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	..	64—66	..
120,000	"	Feb. 12		4½%	Tottenham A 5 p.c.	135—138	90—95	..
789,276	"	"	6	8%	District B 3½ p.c.	115—117	65—67	..
181,255	"	June 26	4	4%	4 p.c. Deb.	87—89	56—67	..
158,880	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	1—2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93—95	45—50	45
296,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	108½—109	83—85	..
90,000	"	Feb. 26	3½	35/-	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c.	151—156	88—93	..
255,636	"	"	6¼	40/-	Do. B 3½ p.c.	129—134	68—73	68½—69½
108,076	"	"	—	38/6	Do. C	..	68—73	..
140,865	"	"	—	38/6	New Ordinary	..	68—73	..
353,000	"	"	6½	38/9	Wimbledon 5 p.c.	117—122	6½—73	68½
98,000	"	"	6¾	40/-	Epsom 5 p.c.	121—126	70—75	..
88,416	"	June 26	3	3%	3 p.c. Deb. Stk.	86—89	50—52	..

Price and Quality at Burnley.

To the Burnley Grocers' Association, who had protested to the Local Government Board against power being given to the Corporation to increase the price of gas unless the calorific value was 550 B.Th.U., the Town Clerk has sent a copy of a letter forwarded to the Board on the matter. This states: The Gas Committee decided to instruct the Engineer (Mr. J. P. Leather) to endeavour to keep the calorific value of the gas supplied to the borough at 500 B.Th.U. per c.ft. The price of gas in Burnley is less than the average of other towns similarly situated; and when the Provisional Order is made by your Board, the price will not be raised by the Corporation until it becomes absolutely necessary to do so. The calorific value of 550 B.Th.U. suggested is higher than the highest of the standards named in the report of the Fuel Research Board recently issued. The Board suggest four possible standards—400, 433, 466, and 500 B.Th.U. The Gas Engineer experiences great difficulty in obtaining sufficient supplies of suitable coal. The gas oil the Corporation have in stock cost 1s. 5d. per gallon, and is therefore very costly to use. Comparisons of the calorific value of the gas supplied in 1917 with that now being supplied cannot be correctly made, as the present calorimeter was only obtained in the summer of 1918. It is not yet possible to obtain gas oil except at a price considerably more than double pre-war charges. The Gas Engineer has no objection to a calorific standard being established. He considers it preferable to an illuminating power standard, which has never been found entirely satisfactory.

The King's Visit to Birmingham.—Owing to the coal shortage, there were no street gas illuminations on the occasion of the King's visit to Birmingham; and it is extremely unlikely that there will be any in the city worthy of the name on Peace Day. Apart from the point of view of economy, the Lord Mayor (Sir David Brooks) takes the view that gas illumination can well be dispensed with, having regard to the lightness of the evenings.

The Silvertown Explosion.—A Parliamentary Paper has been issued which sets forth the chief sums paid in compensation for the damage done by the disastrous chemical works explosion which took place during the war at Silvertown. The sums mentioned include £20,000 to the South Metropolitan Gas Company, £2425 to the Gas Light and Coke Company, £30,761 to Messrs. Spencer Chapman and Messel, Ltd., £10,095 to Messrs. Burt, Boulton, and Hayward, Ltd., £1000 to Messrs. Forbes, Abbott, and Lennard, Ltd., £41,193 to the British Alizarine Company, Ltd., and £1095 to the Anglo-American Oil Company, Ltd. The total was over £1,200,000.

The report of Meters Ltd., for the year ended March 31 (to be submitted at the meeting on the 2nd prox.) states that the trading has resulted in a gross profit of £36,520, which is reduced by general management expenses, Directors' fees, legal charges, expenses on patents, income-tax, and depreciation off buildings, machinery, and plant. A sum of £6256 has been charged to revenue for repairs and renewals. After providing for interest on the debenture stock less tax £3791, the net profit amounts to £22,479, which, with £5229 brought forward, makes £27,708, out of which interim dividends at the rate of 5½ p.ct. per annum upon the preference shares, and at the rate of 5 p.ct. per annum upon the ordinary shares were paid in November last. The Directors now recommend the payment of further dividends at the rate of 5½ p.ct. per annum upon the preference shares, and at the rate of 12 p.ct. per annum upon the ordinary shares (making the ordinary dividend 8½ p.ct. for the year, less tax), also the payment of a bonus of 3d. per share (free of income-tax) upon the ordinary shares. The sum of £5000 is to be added to the reserve fund (making it £117,000), leaving a balance of £5122 to be carried forward.

Newmills (Ayrshire) and Monifieth have arranged with Messrs Alder and Mackay, Ltd., of Edinburgh, to introduce their "A and M" patent pressure wave automatic controllers upon their street gas-lamps for next lighting season; and Helensburgh and Ardrossan have decided to complete their installations, after the partial lighting which they installed last year.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for May 21.]

Nos. 11,817—12,502.

Appleby, E. G.—"Gas-producers." No. 12,396.
Atkinson, W. H.—"Joints and couplings for pipes and tubes." No. 11,837.
Bentley, G. H.—See Appleby. No. 12,396.
Biles, G. W.—"Control of taps, cocks, &c." No. 12,164.
Brown, W. D. R.—"Apparatus for automatic and continuous analysis and recording of gases." No. 12,317.
Camp, R. M.—"Gas-cookers." No. 12,310.
Cannon Iron Foundries.—"Gas cooking-stoves." No. 11,817.
Clark, A. H.—"Fire-lighter for lighting by gas." No. 11,836.
Cordt, J. B. van.—"Apparatus for admitting high-pressure lighting gas into gas-mains." No. 12,451.
Davies, W. E.—"Distillation of coal, shale, peat, wood, &c." No. 11,959.
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